SCIENCE
MAR 19 1917
Univ. of
Library

McGRAW-HILL PUBLISHING CO
POWER
AMERICAN MACHINIST
ENGINEERING AND MINING JOURNAL
ENGINEERING NEWS
COAL AGE
ENGINEERING WEEKLIES

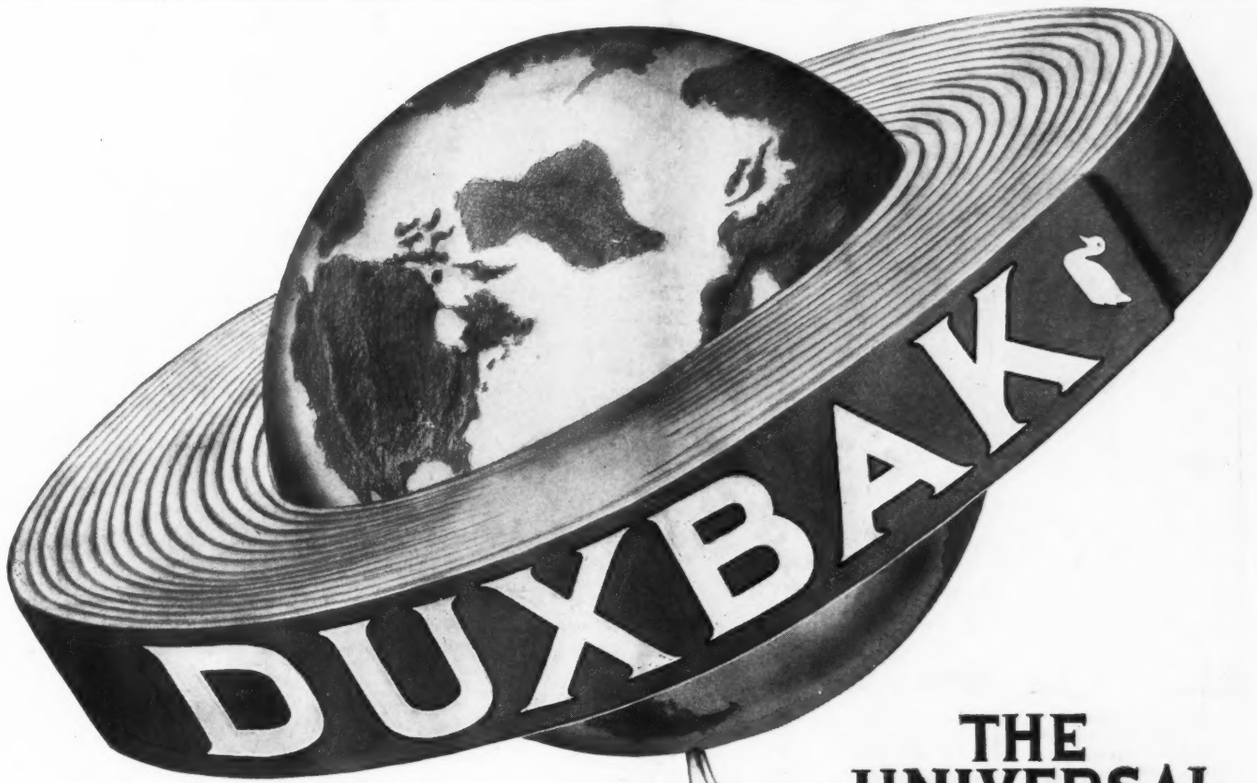
Engineering and Mining Journal

With which is consolidated Mining and Engineering World

Volume 103, No. 11
Issued Every Saturday
McGraw-Hill Publishing Co., Inc.

NEW YORK, MARCH 17, 1917

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page



DUXBAK
is the Universal Belt for two reasons:

(1) It is the Best Belt for *Every* Drive, outlasting others where no difficulties are encountered and transmitting maximum power where others fall down completely under adverse conditions. (2) It is the Most Used Belt in the World.

Try one of these water-, oil- and weather-proof belts—it pays.

Chas. A. Schieren Company
ESTABLISHED 1868.

Tanners, Belt Manufacturers

DUXBAK BELTING
TRADE MARK
Reg. U. S. Pat. Off.

NEW YORK - - - 39 Ferry Street

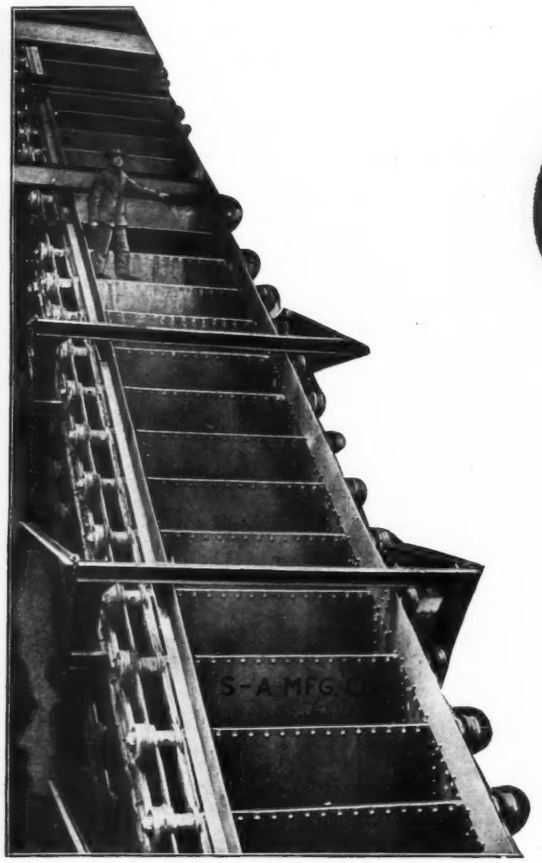
Denver ..... 1752 Arapahoe Street
Boston ..... 641-643 Atlantic Ave., opp. So. Sta.
Chicago ..... 128 West Kinzie St.
Philadelphia ..... 226 North Third St.
Pittsburgh ..... 337 2nd Ave.
Seattle ..... 305 First Avenue, South
New Orleans, La ..... 404-406 Canal St.
Atlanta, Ga ..... 272 Marietta St.
Memphis, Tenn ..... 475 So. Main St.
The Texas Chas. A. Schieren Co., Inc., 205 So. Market St., Dallas, Tex.
Oak Leather Tanneries, Bristol, Tenn.

THE UNIVERSAL BELTING

Awarded the Gold Medal of Honor at San Francisco Exposition

The S-A Page

Published Weekly in the Interests of S-A Conveying Engineering



1000
Tons Per Hour Up A 45° Incline
A Continuous Performance

The illustration shows the S-A Steel Pan Conveyor installed at the Tomkins Cove Stone Crushing Plant, Tomkins Cove, N. Y. It is fitted with pans 72 inches wide. The distance between centers is 120 feet. The conveyor has been in service for years with very few repairs, continuously delivering 1000 tons per hour up a 45-degree incline.

S-A
Steel Pan Conveyors

THEY mean the maximum in economy and output. Made up of heavy steel pans carried on steel bushed roller chains. The shape of the pan is determined by the angle of inclination. The chain consists of heavy steel bars arranged in pairs on either side of the pans and suspended from heavy steel crossbars. Very simple and sturdy in construction. All parts are readily accessible and easy to keep perfectly lubricated.

Designed with a very high factor of safety.

The S-A Engineers have specified for years in solving ore, rock, coal and other heavy bulk material handling problems. Their experience is placed at your command for determining the most economical methods in conveying and elevating ore in your mill. Consult them freely. We make no charge for this service.

Let us mail you our free monthly publication "THE LABOR SAVER." You'll find it full of helpful suggestions. Send in your name today.

STEPHENS-ADAMSON MFG. CO. - - Aurora, Ill.

Conveying, Screening

Transmission Machinery

50 Church Street.....New York, N. Y.
First National Bank Bldg.....Chicago, Ill.
H. W. Oliver Bldg.....Pittsburgh, Penn.
Federal Reserve Bank Bldg.....St. Louis, Mo.
First National Bank Bldg ..Huntington, W. Va.
503 Dooly Block.....Salt Lake City, Utah
J. W. Gates, District Manager.

Branches:

79 Milk Street.....Boston, Mass.
Colwell & McMullin, District Managers.
824 Dime Bank Bldg.....Detroit, Mich.
310 Stair Bldg.....Toronto, Ont.
E. J. Banfield, Agent.

So. African Agent...J. MacG. Love & Co., Ltd.
1 and 3 London House, Loveday Street, Johannesburg, So. Africa.
Australian Agent.....Arthur Leplastrier & Co.
Circular Quay East, Sydney, Australia.
Scandinavian Agent.....C. S. Christensen, A/S
Post Box 85, Kristiania, Norway.
Cable Address.....Saco

Engineering and Mining Journal

VOLUME 103 MARCH 17, 1917 NUMBER 11

The Ajo District, Arizona

By A. J. Hoskin*

SYNOPSIS—The Ajo district in Pima County is the scene of great activity. Principal operator is the New Cornelia Copper Co., which has proved 40,000,000 tons of 1.5% copper ore and erected a 5000-ton leaching plant, which will go into operation in April, 1917. Several other smaller companies are doing exploration and development work.

As far back as the early 60's, it is claimed, the existence of copper in the western part of Pima County, Arizona, about 25 miles north of the Mexican border, was known to a few Mexicans and Papago Indians, who dug rich native copper and cuprite ore from shallow holes and hauled it by ox-teams to the coast, whence it was shipped to Wales for reduction. But, except for such small-scale and primitive operations, the region remained virgin until about the beginning of the present century. Mining claims were surveyed by venturesome prospectors who made efforts many times to secure the attention of capital. Two or three companies were organized, and attempts were made at development and the local treatment of the copper ores, but no real success was attained.

Until recently interest in this vicinity has centered exclusively in the New Cornelia and the Ajo groups, the name of the camp being derived from the latter. A considerable amount of development work was done on the Ajo group, along numerous veins in rhyolite varying in thickness from 6 in. to 3½ ft. and well mineralized with oxides and sulphides of copper. Shafts were sunk, and a considerable tonnage of rich ore was mined and hauled in wagons across the desert. Near the surface, rich shoots of cuprite, chalcocite and a little native copper were uncovered. With depth the copper was found as bornite and chalcocite. In the adjacent New Cornelia group the ore is a mass of monzonite porphyry with stringers and dissemination of copper minerals. The primary minerals are chalcopyrite and bornite, which have changed near the surface to iron oxide and malachite. Below the shallow surface oxidation it is not uncommon to find, within fragments of the monzonite, particles or veinlets of the original sulphides; while below the water level the primary minerals are found intact. Chalcocite is relatively rare in this property.

The rocks of the region are all igneous (if a few very small patches of recent conglomerates that have accumulated in modern stream-courses are disregarded). Among the flows that must have taken place over a long period, there can be found andesite, basalt, granite, diorite and diabase in addition to the monzonite and rhyolite already mentioned. Close to the town of Ajo the prevailing rock is rhyolite dipping in all directions from a central mass of monzonite porphyry that lifted up the rhyolite into a great dome, the apex of which is still discernible by a small horizontal patch of rhyolite on the top of Copper Mountain. This hill, shown in the illustration on the right, and four others, some of which are shown in the illustration on the left, comprise all the rhyolite batholith that outcrops in the vicinity. It is probable that the vent whence this great sheet rose may lie directly beneath these hills. The New Cornelia Copper Co. owns all this monzonite area, the copper bearing portion being about 55 acres. The holdings of the Ajo Consolidated Copper Co. are immediately adjacent to the New Cornelia group to the east in the rhyolite area.

THE NORTHERN PART OF THE NEW CORNELIA PROPERTY ON THE LEFT, AND COPPER MOUNTAIN AND NEW CORNELIA DEVELOPMENT PLANT ON THE RIGHT

*Mining engineer, Box 526, Leadville, Colo.

A short distance in any direction from the town of Ajo are found outcrops of the various other eruptives mentioned. The eruptions appear to have followed one another at long intervals; metamorphism was produced along with distortions. The mapping of the area geologically has never been done thoroughly except in the vicinity of the town, but it will probably be required in the proposed mining activities of several new companies that have taken up properties in the outlying parts of the district. Among these companies is the Arizona-Jerome Copper Co., owning the South Cornelia group of 330 acres about three miles south of Ajo. Here are found all the rocks mentioned with the exception of the monzonite, which is presumed to be present at considerable depth. The different flows outcrop in approximately parallel bands from a few to several hundreds of feet in thickness, but these are undoubtedly the upturned edges of sheets having strikes about N 55° W. There is usually a distinct cleavage along the same course, although in places there are sharp cross-strikes due probably to structural stresses.

Different Mineralogical Conditions in Southern Part of District.

The conditions in the mineralization of this outlying southern part of the district are different somewhat from those in either of the two chief properties upon which exploration work has been done. Little development has been done upon the South Cornelia ground, so that the study of the formations and the minerals is limited to exposures in many small, shallow discovery pits and prospect holes. It is found, however, that copper occurs in every type of rock, although, from present exposures, the best showings are in the rhyolite. The rocks contain myriads of tiny fractures, the majority being along the planes of cleavage, and these fractures contain veinlets of chalcocite which has altered to malachite near the surface. Systematic exploration of this area by shaft-sinking is already under way with the object of determining the conditions at depth. In one or two holes the showings are good, and the company hopes to prove the presence of large tonnages of low-grade copper ore that may be excavated by openpit methods.

The region is desert; there is no grass of any sort, but ironwood, greasewood, paloverde, manzanita and numerous varieties of cactus thrive. Prospecting in this region is an occupation involving real hardships. During the summer the prospector must endure intense heat by day, shortage of water and constant danger from pests such as ants, tarantulas and scorpions. Gila monsters infest the region, but they are so sluggish that they seldom are dangerous to human beings. Tents are usually occupied for sleeping, but cooking and eating are done in the open air. The winters as a rule are pleasant, although the present season has been exceptionally cold at times.

There are no streams or bodies of water for many miles in any direction. All water for domestic consumption is purchased from peddlers who maintain primitive tank-wagon service daily from the mains of the New Cornelia Copper Co. This company, as a preliminary necessity, drilled a large 600-ft. artesian well about six miles to the northeast and was successful in developing an abundant flow of remarkably pure water. It is piped throughout the town of Cornelia and will be a tremendous asset in the proposed metallurgical operations of the company.

Ajo is about 45 miles from the station of Gila Bend on the Southern Pacific Ry. The distance is crossed by a fairly good wagon road and by the new Tucson, Cornelia & Gila Bend Ry. owned by the Calumet & Arizona Copper Co., of which the New Cornelia Copper Co. is a subsidiary.

Experiments on the New Cornelia ore began in April, 1912, and have been continued almost without interruption to date. An experimental plant of 40 tons daily capacity was first erected close to the great deposit, the process selected being acid leaching. Machinery for grinding, including a tube mill, was hauled by teams across the desert. Concrete leaching and solution tanks were built. Water for the process was also hauled in wagons. This temporary plant was completed in January, 1915, and went into immediate service. Approximately 12,000 tons of the raw surface ore was handled in 291 experiments. The results were such as to justify greater investigations. Meanwhile the ground had been most systematically sampled by 84 diamond-drill holes and 77 fifty-foot test pits. This sampling proved the existence of more than 40,000,000 tons that would average 1.5% copper, most of the material being available for steam-shoveling. The drill holes varied in depth from 200 to 1000 ft. The oxidized zone was found to extend to a very uniform level that coincides with the permanent water table. Of the proved ore, approximately two-thirds is designated as oxidized or carbonate. As thus far tested there is little, if any, difference in copper tenor between the carbonate and the sulphide ores. Gold and silver occur in a very small amount—perhaps 15c. per ton.

One spur of the railroad lies along the eastern foot of Copper Mountain, the central hill in the New Cornelia property as shown in the illustration. The shed-like structure in the foreground is the temporary electric and compressed-air plant that was used during the initial development of the property and contains machinery driven by an oil engine. The adit whose portal shows just above the large dump leads back into the hill and connects with a glory hole. Shipments in trainloads have been made to the Calumet & Arizona works at Douglas, but these have been discontinued and further treatment of the New Cornelia ore will await the completion of the big new plant—probably about April, 1917. This plant is designed with a daily capacity of 5000 tons. As the ore is delivered at the works, it is put through one large and five smaller gyratory crushers before being delivered by conveyors to the storage bins. From these bins the ore is taken by conveyors to twelve 4-ft. Symons disk grinders that reduce it to ¼ in. the ultimate fineness required. On its way thence to the leaching tanks, the ore is automatically sampled.

Leaching at New Cornelia

The leaching department contains 12 lead-lined concrete tanks, each 88 ft. square and 15 ft. deep, arranged in two parallel rows, in the open air. A complete pumping unit accompanies each tank, and the 3% sulphuric-acid solution is forced into and through each tank at the rate of 8000 gal. per min. Each tank will hold one day's ore supply. The solution is caused to advance from tank to tank according to the order of charging, the fresh solution passing first through the oldest charge and then in sequence through the succeeding charges. The pregnant solution from the last tank passes to the electrolytic tank-house containing 158 lead-lined tanks each 4 ft. wide, 30 ft. long and 5 ft. deep. The solution traverses these tanks longitudinally, passing between the lead anodes and the

copper cathodes. Upon being restandardized—which is largely done in the electrolysis—the solution is returned for use in the leaching department. Owing to the dissolving of some iron and alumina from the ore, the solutions have a tendency to foul. Therefore, to maintain a good grade of solution, it will be necessary to discard a small amount of it after it passes the electrolytic cells and to pass it over scrap iron for recovering the residual copper in the form of sludge.

A feature of this plant that will prove unusually interesting is the type of machine that has been designed and built for excavating the tails from the leaching tanks. Briefly, this excavator is a traveling crane spanning the rows of tanks. Instead of running upon elevated tracks, however, it will travel on heavy rails laid level with the mill floor. Upon the structural framework, high above the tanks, is a so-called trolley traveling at right angles to the main carriage. This trolley supports a heavy walking beam upon the outward end of which is suspended the large bucket leg from which is hung the 10-ton bucket of the clamshell type. The entire machine is under the control of a single operator, who will lead an interesting life, for his station is within the bucket leg and he will surely have his "ups and down in life." After each bucket load is scooped from a tank, the walking-beam mechanism lifts the bucket clear and the trolley travels to one end of its track, where it stops while the bucket is dumped into the waiting dump-car. The machines capacity is expected to be 500 tons per hour and was built by the Wellman-Seaver-Morgan Co., Cleveland, Ohio. The new power plant comprises five oil-fired Stirling boilers having a combined capacity of 4100 hp., two steam turbines of 7500 kw. each and three 1500-kw. motor-generator sets.

Living conditions at present are somewhat hard at Ajo, owing to the inrush of laborers and prospectors. The usual shelter is the tent. When finished, the town of Cornelia will prove the better place of habitation. The New Cornelia Copper Co. owns the town and is erecting many substantial concrete, tile and sheet-iron buildings. These are primarily intended for occupancy by employees. The company is also building stores, a hotel and a bank, all of which will be run by its own employees and managers. No kind of business will be permitted within the town's limits except that conducted on company account. Upon lands contiguous to Cornelia lots have been platted for the towns of Gibson and Clarkson, and these will probably contain numerous stores, boarding houses, theaters, etc., operated by private capital.

History of the Divining Rod

The idea that a forked twig, or so-called divining rod, is useful in locating minerals, finding hidden treasure or detecting criminals is a curious superstition that has been a subject of discussion since the middle of the Sixteenth Century and still has a strong hold on the popular mind, even in this country. This is evident from the large number of inquiries received each year by the United States Geological Survey as to the efficacy of such a twig, especially for locating underground water. To furnish a reply to these inquiries the Survey has published a paper[1] by Arthur J. Ellis, on the history of divining-rod practice with a bibliography that includes a truly astonishing number of books and pamphlets on this subject.

It is doubtful whether so much investigation and discussion have been bestowed on any other subject with such absolute lack of positive results. It is difficult to see how for practical purposes the entire matter could be more thoroughly discredited. It is by no means true that all persons using a forked twig or some other device for locating water or other minerals are intentional deceivers. Some of them are doubtless men of good character and benevolent intentions. However, as anything that can be deeply veiled in mystery affords a good opportunity for swindlers, there can be no reasonable doubt that many of the large group of professional finders of water, oil, or other minerals who take pay for their "services" or for the sale of their "instruments" are deliberately defrauding the people and that the total amount of money they obtain is large. To all inquirers the United States Geological Survey therefore gives the advice not to expend any money for the services of any "water witch" or for the use or purchase of any machine or instrument devised for locating underground water or minerals.

History of the Superstition

In tracing the history of the subject, it is found that divining rods have been used for a great variety of purposes, including the location of ore deposits, buried or hidden treasure, well sites, the finding of lost landmarks and animals, the detection of criminals and the analysis of personal character. They have been used as fetishes to insure immunity from disease. They have been used to determine the amount of water available by drilling at a given spot, the depth at which ore or water occurs, the direction of the cardinal points, and the height of trees, and to analyze ores and water.

The origin of the superstition is lost in antiquity. What is believed to be the first published description of the divining rod is contained in Agricola's "De re metallica," which was published in 1556. The device became common in Germany, and it was introduced into England by German miners during the reign of Elizabeth, and before the end of the Seventeenth Century had spread throughout Europe. Everywhere it aroused controversy. The rules prescribed for the cutting of the twig partook largely of heathen sorcery and astrology and were directly traceable to the old Scandinavian and Aryan mythology. But this heathen influence was offset when the rod was duly Christianized by baptism, being laid for this purpose in the bed with a newly baptized child, by whose Christian name it was afterward addressed. It is readily conceivable that the motive for surrounding this practice with a religious atmosphere might not have been altogether a belief in its divine character, for at that time anyone found engaged in mysterious works was in danger of being charged with sorcery and burned to death at the stake.

The divining rod continued to be a favorite subject with alchemistic writers until about 1660, when a new turn of affairs was brought about by a Jesuit father, who denounced it as an instrument controlled by the devil. The subject was then taken up by the church, and for more than 100 years it was hotly debated by churchmen. In 1692, the year of the Salem witchcraft, its notoriety was greatly increased by the arrest and execution of a criminal through the agency of a peasant who used a divining rod.

[1] "Water-Supply Paper 416" can be obtained by addressing the Director, United States Geological Survey, Washington, D. C.

As late as 1703 this peasant was employed to point out with his divining rod Protestants for massacre, under the plea of punishment for crimes they had committed. The divining rod was in some respects closely related to witchcraft, as is suggested by the use of incantations in connection with divining, and to this relationship may be ascribed in some measure the strengthening of belief in it. Witchcraft at that time had become a frenzy, and anything which by any stretch of the imagination could be suspected of implication with witchcraft became a subject of discussion and the basis of firm opinions and beliefs. In 1701, however, the Inquisition issued a decree against the further use of the divining rod in criminal prosecution, and this use of the device rapidly came to an end.

In the last of the Eighteenth Century an attempt was made to explain water-witching as an electric phenomenon, and later it was discussed as a psychic phenomenon. At almost every step in the advance of science someone has attempted to explain its supposed operation by means of the latest scientific theories.

Before the present war there were several societies in Germany whose sole object was said to be the study of the divining rod. In 1910 the Department of Agriculture of France appointed a committee to investigate the subject, and in 1914 this committee was still investigating.

⁂

Red Mountain—A 40-Year Monument to the Crosscut Tunnel

By A. G. de Golyer*

There is some interesting work now going on in the Red Mountain section of the San Juan mining district of Colorado, which, if it is successful, will have an important influence on mining in this district. I refer to the effort on the part of the Vernon Mining Co. to develop a mine on Red Mountain by the simple process of following the ore downward from the surface—something that the Red Mountain miner has woefully neglected in the past, with the result that Red and Brown Mountains have stood out for years as apparently non-producers right in the heart of the San Juan triangle.

To my knowledge, and I have known this section since a boy, the orebodies have not been followed from the surface since the days of the Yankee Girl, Guston and other bonanzas far down on the western slope of Red Mountain, and even then this fundamental rule of mining science as taught in our schools and colleges was applied only to the zone near the town of Ironton. And as I see it, the only reason they followed their ore streaks down even there was that the tunnel sites were mostly above the croppings and therefore there was no place to start except on the vein and no particular direction to go except down. The result was that mines were opened there, whereas the orebodies in the mountains around have been scratched only by the hand steel and "dinner-bucket" bailing apparatus of the prospector and have been aimed at but never hit by ambitious crosscut tunnels with their faces about half way into the objective points.

Here then are two mountains geographically in the center of a productive mining district and geologically in the best formation, the andesite. On these mountains, where the ore had been seriously followed, meager surface showings had developed into immensely productive mines from about the 200-ft. level down. Other showings, equally good and even much better, but handicapped by possessing a crosscut tunnel site, are still showings and nothing more. Surely this was ground for serious prospecting—for ore following.

Away up on Red Mountain, in Gray Copper Gulch, I have been instrumental in having the Vernon Mining Co. take hold of the South Dakota and other claims through which the South Dakota and Vernon veins take their course, being visible for a mile or more on the surface. The South Dakota is without doubt one of the strongest fissures, if not the strongest, in this entire section, and has been so characterized by the United States Geological Survey. This fissure is from 80 to 100 ft. in thickness and dips at an angle of about 45° toward a probable intersection with the Vernon vein at a depth of around 300 ft. or a little deeper. In this big vein, in the most favorable formation of the San Juan country, leasers years ago did some work around a depth of 50 ft. and shipped ore from a chamber which reached a width of 20 ft., this ore being the characteristic highgrade of the section. After the manner of leasers, ore had a great attraction for them and they, of course, underhand stoped, thus greatly disturbing the owners of the property, who in turn canceled the lease. The leasers left the operations with a substantial orebody showing in the bottom of their workings at a depth of 50 ft., but there the matter rested.

Vernon Following the Vein Down

The Vernon Mining Co. has equipped this property with modern, electrically operated machinery and is now sinking its shaft in the South Dakota vein, paralleling the orebodies as shown in the shallow workings. The shaft is now down a little more than 250 ft. and is going down at the rate of about 20 ft. a week. The company will push the shaft down to the intersection of the two veins and develop laterally at the 300 and below.

The shaft was not started in the oreshoot of the South Dakota vein, but at a depth of 150 ft. ore commenced to come into it, and below that depth the shaft has continuously showed increasing mineralization. The question is, What will be found on the 300 and below? To my mind, and I have followed this district closely for years, the increasing mineralization in the shaft can have but one meaning—the same that it has had in the successful mines of this camp.

If the Vernon develops into a mine, it will mean a time of rejuvenation for Red Mountain and it will mean the development at depth of a dozen other promising surface showings which have been only scratched by leasers and prospectors. It will be but one more instance of the wisdom of the old maxim, "Follow your ore." In other words, it will mean that 40 years have been wasted on Red Mountain, for during the last 40 years mines have been made on all sides of this peak, while it rested a monument to the fallacy of driving crosscut tunnels of considerable length and always at great expense of both time and money.

⁂

A College Course on the Human Side of Engineering has been outlined by the industrial department of the International Committee of Young Men's Christian Associations, 124 East Twenty-eighth St., New York. A copy of the outline together with a list of reference books may be obtained by applying to F. H. Rindge, Jr., at the foregoing address.

*Consulting mining engineer, Ouray, Colo.

Depreciation and Measurement of Expired Outlay on Plant—II*

By E. A. Erickson†

SYNOPSIS—A system of keeping a plant register is suggested and exemplified. Original cost of plant should be kept out of revenue account, only a part being charged each year; but expense for tools, utensils, repairs and partial renewals should be charged as incurred. Depreciation considered a charge against inevitable decay, rather than annual value.

If the system of plant register should come into general use, a kind of standard would speedily be established, and we should get rid of the extreme state of affairs which at present allows profit to be computed and dealt with without making any provision whatever for depreciation or expired outlay on productive plant.

These units of productive plant should, if movable, bear an identification number; or, if fixed, they should be so described in the register of plant that identification would be always easy and it would be possible to say how much of the original outlay thereon had then expired, as measured by the declared length of life. What are natural or customary units of productive plant I propose to discuss later in this article.

TABLE 1. REGISTER OF PRODUCTIVE PLANT

Description of productive plant: *Pumps*
Length of efficient economic life: 10 yr. (equal to 10%)
Date of declaration: *Jan. 1, 1895.* Declared by *W. A. Jones*
Date of subsequent declaration..... Declared by.....
Section: *P*
Sheet 40
Certified by *A. Smith*
Certified by.....

Depreciation Year	Capital outlay during the years ending Dec. 31, and subsequent annual depreciation deducted therefrom 1895	1896	1897	1898	1905	1906
1895	$1,000.00					
	50.00					
	950.00	$1,000.00				
1896	100.00	50.00				
	850.00	950.00	$500.00			
1897	100.00	100.00	25.00			
	750.00	850.00	475.00			
1898	100.00	100.00	50.00			
	650.00	750.00	425.00			
1899	100.00	100.00	50.00			
	550.00	650.00	375.00			
1900	100.00	100.00	50.00			
	450.00	550.00	325.00			
1901	100.00	100.00	50.00			
	350.00	450.00	275.00			
1902	100.00	100.00	50.00			
	250.00	350.00	225.00			
1903	100.00	100.00	50.00			
	150.00	250.00	175.00			
1904	100.00	100.00	50.00			
	50.00	150.00	125.00			
1905	50.00	100.00	50.00			
		$50.00	$75.00			

A convenient form for a register of plant is a loose-leaf book of suitable size having pages alloted to each class of productive plant, each page ruled with 12 separate cash columns (one for each year), each page being headed with a description of the productive plant and the declared length of life in years and having a space for the signatures of the officers responsible for declaring that length of life. Such a register of plant is shown in Table 1 and requires no special description.

In making up the financial accounts at the end of each year, the original or renewal outlay during the year on each class of productive plant (as shown by the ordinary financial ledgers) is transferred in total to the appropriate page and column for the particular year in the register of plant. A half-year's depreciation is then deducted therefrom; which, added to the one year's depreciation deducted from each of the still unexpired amounts appearing in the previous column, enables the total provision for depreciation on that particular class of plant for the year to be ascertained and transferred to a summary sheet, such as shown in Table 2.

TABLE 2. REGISTER OF PRODUCTIVE PLANT—SUMMARY

Description of productive plant: *Pumps*
Length of efficient economic life: 10 *yrs.* (equal to 10%)
Section..... Sheet.....

	(a) Capital Outlay +	(b) Depreciation —	(c) Balance of Unexpired Capital Outla
1895	$1,000.00	$50.00	+$950.00
Total	1,000.00	50.00	950.00
1896	1,000.00	150.00	+ 850.00
Total	2,000.00	200.00	1,800.00
1897	500.00	225.00	+ 275.00
Total	2,500.00	425.00	2,075.00
1898	.....	250.00	— 250.00
Total	2,500.00	675.00	1,825.00

The totals of (a) capital outlay, (b) depreciation, (c) balance, increasing or decreasing the expired capital outlay for each class of productive plant, will be ultimately abstracted from each of the current class summary sheets to a general summary for the year.

TABLE 3. ANNUAL GENERAL SUMMARIES

Section..... Sheet.....

1895	Capital Outlay +	Depreciation —	Net—Balance of Unexpired Capital Outlay
Pumps	$1,000.00	$50.00	+$950.00
Motors	6,000.00	600.00	+5,400.00
Drills	12,000.00	300.00	+11,700.00
Mill Machinery	11,000.00	100.00	+10,900.00
Hoist	48,000.00	2,000.46	+45,999.54
Electric-Trolley	10,000.00	47.00	+9,953.00
	$88,000.00	$3,097.46	$84,902.54

The depreciation column of this general summary shows the amount necessary to be charged to revenue account for the year before any profit can be realized. Many years' history of hundreds of different classes of productive plant can be recorded in a register of this kind without any confusion; and if, during the life of any class of productive plant, it is found (in the light of subsequently acquired knowledge) that the original estimate was over or under the mark, this can be adjusted and effect given to it so as to provide for the then-unexpired balance, appearing in the register, being written off over any altered remaining period. Thus an effective review or survey of the financial position of a company keeping a systematic record of this kind could be carried out periodically with considerable precision, and effect given to the altered conditions of some of the classes of

*Continued from "Eng. and Min. Journ., Mar. 3, 1917.

†262 South Auburn St., Grass Valley, Calif.

productive plant, by suitably modifying the economic life-period in the register of plant to meet the new circumstances; and, further, there would be a permanent record of this always available.

Productive plant, which I have defined as comprising all perishable material property owned by the company, includes loose tools and utensils, and precisely what these are should be defined by schedule to be settled according to the circumstances of each case. The exact value at any time of these loose tools and utensils can be ascertained by an annual stock-taking. All outlay both for renewal and repair of loose tools and utensils should therefore be charged to the revenue account of the year in which it is incurred, subject to adjustment of stock values at the beginning and end of each year. This should be shown as a separate item or items in the revenue account.

All productive plant, except that dealt with as loose tools and utensils, should be classified and recorded in the register of plant, showing the year of purchase and original cost. The characteristic common to this productive plant is that the original cost will be found to be a payment made in order to secure future advantages in earning revenue, and therefore, to the extent that it is a payment in advance, is not properly chargeable to the revenue account of the year in which it is incurred. For this reason it demands careful record and suitable subsequent treatment.

The original cost of all productive plant, whenever purchased, should always be kept out of revenue account. This account will, however, in lieu thereof, be inexorably charged each year with a sum to cover the part expiring within the year of all such advance payments. This charge should be shown separately in the books of the company and in the revenue account presented for the consideration of the directors. Personally I believe it should be shown separately on the published accounts, but this is a matter to be settled according to the circumstances of each case.

Repairs and Partial Renewals Are Chargeable to Revenue Account

Besides the annual charges to revenue account represented by the adjusted expense of loose tools and utensils and the expired outlay on other productive plant as measured, there will be the cost of repairs and partial renewals of this other productive plant to be shown separately for the information of the directors.

The most difficult question—common, however, to all methods of accounting—is that of determining what are renewals, the cost of which must not be charged to the year's revenue account, and what on the other hand are partial renewals, the cost of which will come out of the revenue of the year in which they are incurred. It depends upon the particular class of undertaking and can best be settled by means of standard schedules prepared, after careful consideration, with the coöperation of the engineer's and accountant's departments.

What is a unit of productive plant or, as I have called it, a natural or customary unit must be determined in each case by the nature of the particular undertaking. Thus the original cost of construction of a mill would be one unit, but mills would be divided into different classes according to the nature of their construction and consequent probable economic life.

A power plant would seem to be a natural unit; but the efficient economic life of the transformers, motors and compressors may all differ; so that for the purpose of record in the register of plant this property would probably by custom be divided under no less than three heads or classes. Similarly, with the electric railway, if the motor has a shorter economic life than the truck, it would be an easy matter to record the cost under two heads instead of one.

Suppose the cost of a mill having an estimated life of 20 years was $60,000, and that at the end of 10 years the mill is partly pulled down and a new one built; the new expenditure being double the cost of the original mill, or $120,000. It would be possible to say definitely that $30,000 had been taken out of revenue during the 10 years for expired outlay on the original mill, the life of which had been estimated at 20 years. It might be determined either to write off the remaining $30,000, in whole or in part, over the next few years, or add it to the $120,000 new expenditure, and immediately thereafter revenue account would begin to contribute to the reduction of the new total of $150,000.

Depreciation Charge is Not Annual Value, But a Charge Against Inevitable Decay

The charging of $5000 or $10,000 per annum to revenue is, of course, not intended to represent the annual value of the mill, but stands only for the inevitable decay of the structure which forms part of the operative expense of the company, whether it be so recorded or not.

The habit of considering new ventures in the light of the probable length of the economic life of the productive plant represented by the capital outlay is a good one as it often shows that the future prospects are by no means so sound as they may otherwise appear to be, and if it should be found in looking at the matter in this way, that revenue account cannot take the necessary annual burden, the inevitable conclusion is that the undertaking is not really on profit-earning lines.

The practice generally adopted by mining companies of charging the cost of renewals to the revenue account of the year when the outlay is incurred depends for its efficiency upon the strictness with which it is carried out, and the examination of the accounts of mining companies in recent years shows that very large sums have been charged to revenue in respect of renewals so that substantial provision has been made, although—I venture to think—by wrong methods. Again, under this method it is always possible for a sanguine temperament (especially in years when the revenue account shows a lean result) to regard too large a proportion of outlay on productive plant in the nature of extensions and improvements and as being properly chargeable to capital. Directors are of necessity largely dependent upon the advice of officials in these matters; having no independent gage or measure to enable them to form an opinion as to whether a well settled and sound policy is being pursued with the same strictness, whether the results of the year are good or bad.

It may be objected that the charging of revenue account with an equal installment of the original cost of repairs and partial renewals as paid will unduly burden the revenue accounts of the latter years of the productive life of the plant; but it should not be overlooked that against this there is the fact that money originally locked up in the purchase of this productive plant is being gradually re-

leased and will find profitable investment or employment either in the undertaking or by investment in outside securities, and the resulting income will come to the revenue account. Again in a large undertaking annual expenditures on repairs and partial renewal averages itself in a remarkable way.

I am not sure, however, that it would not be an advantage that the burden of extensive repairs, which may be necessary when a particular class of plant is becoming decrepit or obsolete, should tend to fall heavily on revenue at that time, thus forcibly calling attention to the need of replacing this by modern and up-to-date plant.

I have prepared (Table 4) particulars of the outlay on productive plant of a mining company covering a period of 12 years; also a simple statement of finances at the end of the period. The table shows that the undertaking was started in the year 1895, by the end of which year the outlay on productive plant amounted to $88,000 and the depreciation provision amounted to $3097.46, being one-half of a full year's allowance. For the next two years there was a further outlay on productive plant, and at the end of 1897 the balance of unexpired outlay on productive plant amounted to $121,300.66. For the next seven years, to the end of 1904, the yearly outlay on renewals of productive plant amounted to considerably less than the depreciation provision, so that upward of $40,000 of the original outlay for which a capital of about $120,000 was required, became gradually liquidated and would have accumulated in the form of cash or securities. In the year 1905, however, 29,500 was spent on renewals, and $14,040 in the year 1906; so that at the end of 1906 the balance of unexpired capital outlay on productive plant had increased from about $80,000, at which it would have stood at the end of 1904, to $99,980.32. It will be noticed that the annual depreciation for the years 1903, 1904 and 1905 fell somewhat, and this was caused by the fact that the mill, the life of which was estimated as being only 7.7 years, turned out to have a life of 10 years; for it was not until 1905 that I have assumed that it had to be renewed. In practice this might easily have been adjusted, as soon as it was seen by the superintendent that the mill was likely to be efficient for more than 7.7 years.

TABLE 4. OUTLAY ON PRODUCTIVE PLANT OF MINING COMPANY

	Capital Outlay	Annual Depreciation Provision	Year's Increase in Balance of Unexpired Capital Outlay	Year's Decrease in Balance of Unexpired Capital Outlay
1895	$88,000.00	$3,097.46	$84,902.54	.....
1896	34,500.00	7,707.56	26,792.44	.....
1897	19,500.00	9,894.32	9,605.68	.....
			$121,300.66	
1898	8,500.00	10,928.98	.....	2,428.98
1899	7,375.00	11,565.06	.....	4,190.06
1900	850.00	11,917.36	.....	10,067.36
1901	7,350.00	12,298.98	.....	4,948.98
1902	3,450.00	12,745.22	.....	9,295.22
1903	2,690.00	10,934.22	.....	8,244.22
1904	7,650.00	9,732.90	.....	2,082.90
				$41,257.72
1905	29,500.00	10,920.62	18,579.38	.....
1906	14,040.00	12,682.00	1,358.00	.....
	$224,405.00	$124,424.68		
Balance of unexpired capital outlay			.....	99,980.32
			$141,238.04	$141,238.04

Balance Sheet, Dec. 31, 1906

To share capital, 120,000 shares of $1.00 each	$120,000.00	By way of equipment—balance of unexpired capital outlay	$99,980.32
To creditors	5,000.00	Land	3,000.00
		Investments	20,000.00
		Stores, tools, debts and cash	2,019.68
	$125,000.00		$125,000.00

Revenue Account for Year, 1906

To depreciation on expired outlay on productive plant	$12,682.00	By credit balance for year after charging cost of repairs and partial renewals	$19,882.00
To balance of profit	7,200.00		
	$19,882.00		$19,882.00

The assessment, with substantial accuracy, of annual net profit or loss is now a matter of vast importance; and all the necessary factors to which regard must be had, except this one of provision for depreciation, have received careful attention. The factor of depreciation constitutes a very large part of the operative expense of most mining companies, and the hopeless state of chaos into which it has drifted constitutes a grave public danger that is ever assuming the dimensions of a national danger in these days of large financial operations.

Doubtless many consider such suggestions are impracticable; but I am convinced that they are not so and that much may be done to improve present methods, consisting, as they often do, partly of spasmodic allocations of revenue-account balances to reserve accounts to meet requirements of really unknown extent and partly of the rough-and-ready apportionment between capital and revenue accounts of large outlays on combined renewals and extensions that must be adjusted in some way partly to revenue as representing maintenance and partly to capital expenditure as being for betterments. This involves an anxious responsibility being placed upon the shoulders of officials, who have no very definite rules to guide them. If a settled and methodical policy be laid down I think it will be found that although the efficient economic life of any class of productive plant is a matter upon which opinion differs widely, yet there is an outside limit in all cases; and that, even if these outside limits were admitted and provided for out of revenue, a great improvement would ensue.

Lastly, I would remind the reader that during the last seven or eight years there has been a great awakening in this country. Manufacturers, railway directors—even bankers—all recognize the necessity of far-reaching reforms, the obtaining of assistance from science, and greater energy and enterprise; which unquestionably is of happy augury for the future.

Flotation at the Vindicator Mill, Cripple Creek

The new flotation plant of the Vindicator Consolidated Gold Mining Co., at Cripple Creek, Colo., has introduced a novelty into the practice of the camp, in the use of quick-discharge ball mills. Mills of an estimated capacity of 300 tons per day were installed, but up to the date of issuing the company's yearly report, they had not done the work expected of them. By making some changes, however, the estimated capacity is expected to be reached. Results to date are as follows for the flotation mill:

RESULTS ATTAINED IN VINDICATOR FLOTATION MILL

	Dec. 1–Jan. 1	Jan. 1–9	Jan. 9–23
Assay of head	$1.985*	$2.26*	$5.40†
Assay of concentrate	19.34	20.66	40.25
Assay of tailing	0.41	0.38	0.375
Extraction	81.2%	84.4%	93.1%

* Orehouse reject. † Crude mine ore.

The process seems to promise good results, and it is expected to increase the 300-ton plant now operating. As against screening and sorting, which gives a $23 to $35 a ton product and a $2 discard, flotation produces a $40 product and a 35c. tailing at a cost of about $1 per ton.

New Work of the Bureau of Mines

WASHINGTON CORRESPONDENCE

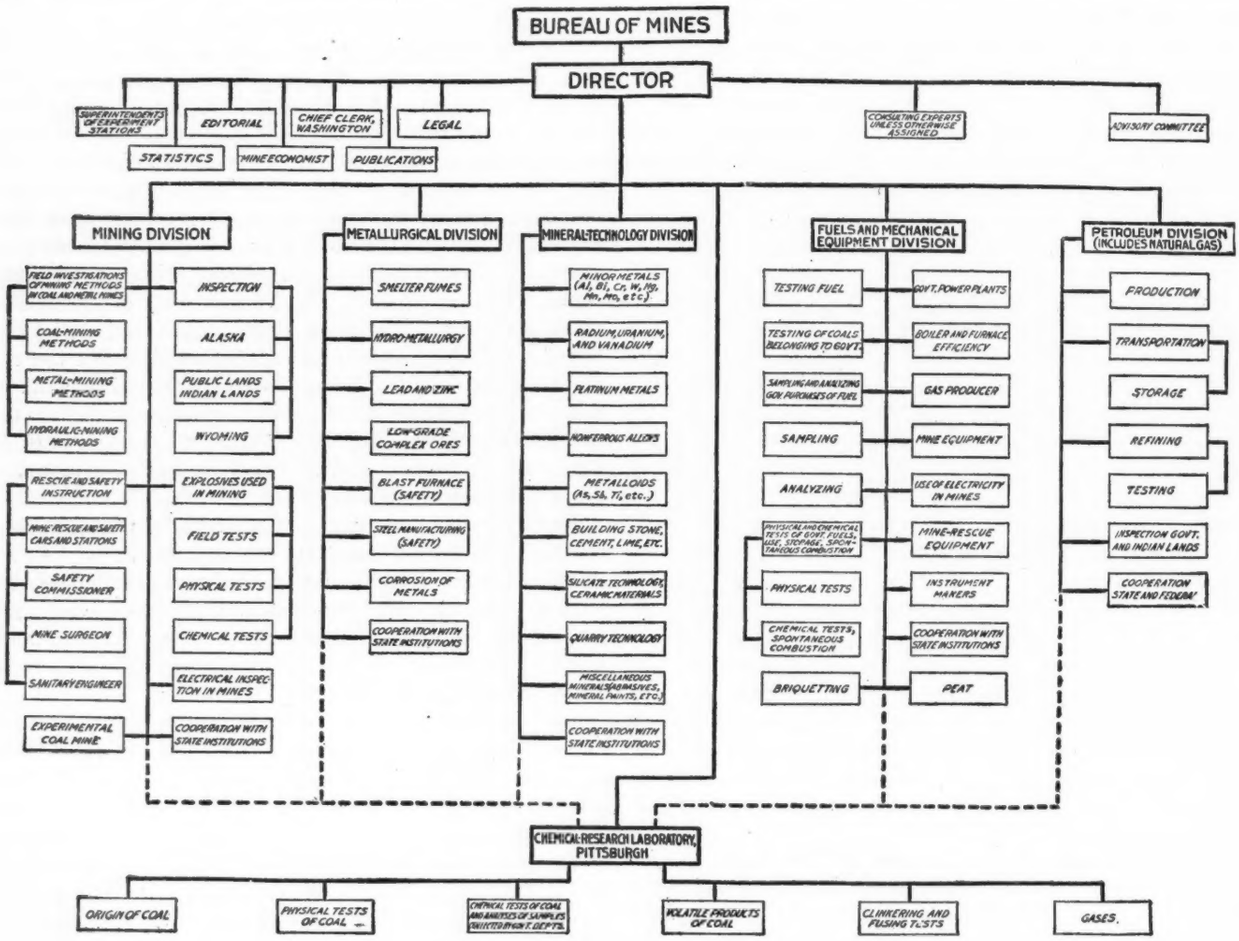
Shortly after Apr. 1 the Bureau of Mines expects to begin the most extensive work it has yet undertaken in the metal-mining regions. At that time the Bureau's three all-steel cars, each with a crew consisting of a mining engineer, a mine surgeon, a foreman miner and a first-aid miner, will begin tours of the territories to which they have been assigned. During this tour an educational propaganda designed to aid all operators and employees will be conducted.

At each mining camp where the cars stop, the mining engineer will offer to inspect mines with the hope of being able to make recommendations that will improve conditions. In the same way the surgeon will offer to make inspections so as to point out ways in which sanitary and health conditions may be improved. Immediately on the arrival of the car the foreman and first-aid miners will take steps to organize classes among the employees for instruction in mine-rescue and first-aid work. Each car is equipped with motion-picture machine and stereopticon. On as many evenings as is practicable, illustrated lectures having a bearing on welfare work will be given.

The cars will be the last word in equipment of this type. They are 80 ft. long and have been designed with the greatest care, so as to make them specially fitted for the work to which they will be assigned. While they will be engaged for the most part in educational propaganda, they will be in readiness at all times for immediate dispatch to the scene of a disaster. They will be equipped with mine-rescue apparatus and a complete line of first-aid paraphernalia.

The car stationed at Butte will have as its territory Montana, Wyoming and Idaho. The car with headquarters at Reno has been assigned to Nevada, Utah and a part of California. The third car will be stationed at Raton, New Mex., and will have as its territory, New Mexico, Colorado and Arizona. The assignments of territory have been made with the understanding that no hard-and-fast boundaries are to be established. This is especially true in the matter of mine rescue. In case of a disaster the car that can be first on the scene will be the one to go.

It is realized that much of the success of this work will depend on the measure of coöperation given by the mine operators. For this reason inquiry has been made in many sections to ascertain how the operators will regard this activity of the Bureau of Mines, and without exception the fullest coöperation has been promised and the results are expected to be of the greatest value.



ORGANIZATION CHART OF THE BUREAU OF MINES

Every railroad line in the territory to be covered by the new cars has agreed to haul them gratis. By eliminating what otherwise would have been a very heavy drain on the appropriations for this purpose, the railroads have made possible an extensive service which the officials of the Bureau of Mines believe will have an immediate and important influence on the metal-mining industry.

The accompanying diagram from the Sixth Annual report by the director of the Bureau of Mines shows the organization chart of the bureau and is interesting as demonstrating the extensiveness of the work being carried on by this department.

The investigations cover the fields of mining and metallurgy and extend into many of their innumerable ramifications. Besides are the important divisions devoted to fuels both solid and liquid and the bureau's classic investigations into coal-mine explosions.

Between four and five hundred employees are on duty in the Bureau of Mines under the direction of Van H. Manning, the director.

There is a movement on foot to put the bureau in the Department of Labor, removing it from the Department of Interior where it has always been. This would probably totally destroy its usefulness and would result eventually in decay of the organization, not through any fault of the bureau, but because it would be placed in such an attitude to the mining business that it could not expect to receive the support and coöperation extended to it now.

Extralateral Mining Rights

By Arthur L. H. Street*

The recently handed-down decision of the Idaho Supreme Court in the case of Alameda Mining Co. vs. Success Mining Co., 161 Pacific Reporter, 862, reaffirms several fundamental principles of lode-mining law. The principal points decided are as follows:

Congress, in enacting mining regulations and in using the terms "lodes, veins and ledges," did not intend to make distinctions based upon genetic principle. When precious metals occur in tilted beds in places associated with subsequent fissuring and mineralization, they are subject to location as veins and lodes within the meaning of the Federal laws.

Judicially defined, an "apex" is that portion of a terminal edge of a vein from which the vein has extended downward in the direction of the dip. It is a point from which the vein has a dip as well as a strike.

The fact that a vein terminates against granite or monzonite does not affect extralateral rights therein.

The course of a crooked vein is not determined by its direction at any given point. An extralateral right must be determined by the course of a vein at its apex at the surface of the claim or at the nearest point to the surface to which the apex extends.

The openings of a mine made during mining operations, and not in support of litigation, should be given more weight as evidence of facts concerning a vein than a mere opinion of an expert witness.

The court overrules the decision of the same court in the Stewart-Ontario Case (23 Idaho Reports, 724, 738; 132 Pacific Reporter, 787, 792) that "to pursue a vein in the direction of its strike at an angle of less than 45° to the course thereof would clearly not be following the vein in its 'downward course,' as authorized by the statute." The court recedes from that statement on the ground that, under the provisions of United States Revised Statutes, Sec. 2322, extralateral rights must be determined by the apex on the surface and not upon the levels disclosed by working of the mine.

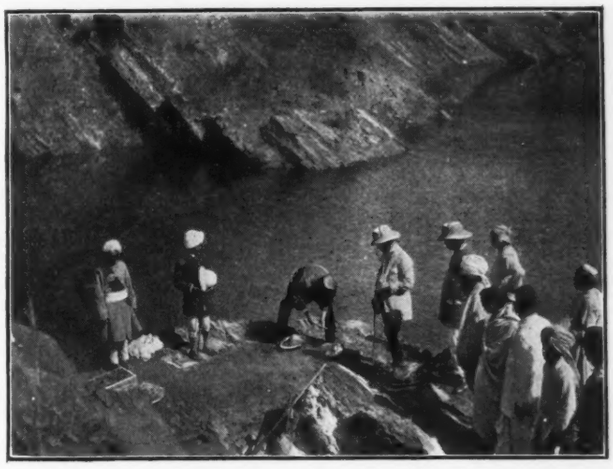
*Attorney at law, 829 Security Building, Minneapolis, Minn.

Hindu Mine Consecration

By John F. Spedding*

A short time ago, I took part in an interesting ceremony which few mining engineers ever have the chance of seeing. It was the consecration of a mine in accordance with Hindu religion.

The mine is an openpit manganese property which has been closed for several years, and is being reopened. One of the owners is a Parsee gentleman, and he suggested that, before beginning work, a little ceremony should be performed in the pit, in order to comply with some superstitious beliefs of the coolies. Accordingly the word was sent around that at 10:30 a.m. the mine was to be "consecrated." In addition to the officials of the works, a large number of coolies gathered. The Parsee gentleman officiated.



A HINDU MINE CONSECRATION

First of all he made a charcoal fire, on which he placed incense and over which he said prayers. Next, he placed offerings of flowers and sweetmeats on an exposed portion of the ore bed (presumably to appease the gods who dwelt therein) and broke a cocoanut, pouring the milk out on the ore. More prayers were said, another cocoanut was broken, and then the ceremony was closed by giving each person an offering of sweetmeats.

It was explained that if no ceremony were performed and any accident happened during the working of the mine, the coolies might attribute it to the fact that the Gods were not appeased, and were showing displeasure!

Austrian Magnetic Bricks are being made, according to a writer in the "Journal" of the Society of Chemical Industry, Dec. 30, 1916, by adding about 8% of ferric oxide to Greek magnesite, which is too pure. It is suggested that when dolomite is used in basic steel furnaces, active calcium ferrates might be formed, the result being destructive to the magnesite foundation.

*Manager, New Gargpur Mining Syndicate, Ltd., Gariajore Mines P. O. via Rajgangpur, B. N. R., India.

Tube-Mill Practice in Rhodesia

By A. W. Allen*

SYNOPSIS—Comparing the performance of three different tube mills under varying conditions and with various linings and pebble charges, gives some interesting information. The classification efficiency was formulated. Close-grained felsite served well instead of the usual Danish pebbles.

Thanks to the opportunity for testing three tube mills at the Lonely Reef Mill, Rhodesia, South Africa, with different linings and under varying conditions, it was possible to make definite comparisons of output and efficiency. Early in 1912 the plant was operating on a system that allowed for the handling of coarse-mesh battery product in cones of the baffle (Caldecott) type and with no further attempt at classification. Each mill was provided with one cone which received a proportionate amount of battery pulp and delivered the underflow to the tube mill and the overflow to the Dorr thickeners.

The original design was based on a misunderstanding as to the efficiency of such a cone, working "dry," to act as a classifier. By estimating the actual undersize and oversize tonnages of underflow and overflow, after adjustment of the cone to produce a minimum of oversize in the overflow and a minimum of undersize in the underflow, the results obtained were poor. Such units often prove useful as dewaterers, but cannot be considered in the same class as vertical-sided classifiers of the mechanical type, such as the Dorr.

In calculating the efficiency of classification a system was formulated for the purpose of a comparative statement of results and was used in the case where a division of 200-mesh material was required. In this system, the total ore tonnage to classifier per 24 hours = A; the tonnage of —200-mesh material in cone overflow per 24 hours = a' and the tonnage of +200-mesh material in cone overflow per 24 hours = a''. Then

$$\frac{100(a' + a'')}{A} = \textit{efficiency of classification}$$

Experience has shown that the only satisfactory method of obtaining classification results from these cones is to use them in series. W. R. Dowling[1] explains that "in all cone as well as in other methods of hydraulic classification it is important to have sufficient return-sand cones, operated with fluid underflow, to receive the overflow of the primary cones, so that the contained sand may be separated and returned to the primary cones. The more complete the separation of slime in the primary cones, the more sand will be contained in the overflow, and hence the greater necessity for efficient return-sand cones."

The inefficiency of the work of these cones at the Lonely Reef mill led to the installation of an additional cone, running "wet," which took the overflow from the "dry" baffle cones, and catered for a large tonnage of coarse material, which inevitably formed a part of the primary-cone overflow.

As shown in Fig. 1 the usual method of erecting tube mills in South Africa is to place them at a considerable height from the ground. This makes the elevation of battery pulp a necessity. Centrifugal pumps are largely used for this purpose, but often give an erratic discharge, especially when the liners and runners are worn. Various methods of dealing with this trouble are taken advantage of, such as the use of equalizing tanks, bypass systems, etc., but classification under these conditions is seldom so satisfactory as when the machine receives a steady feed direct from the battery.

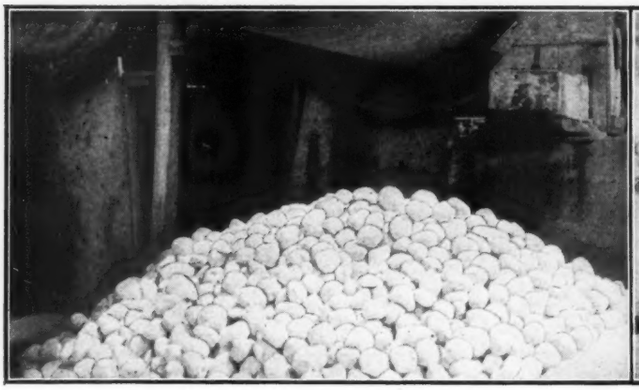


FIG. 1. TUBE MILL EMPLOYED FOR PULVERIZING

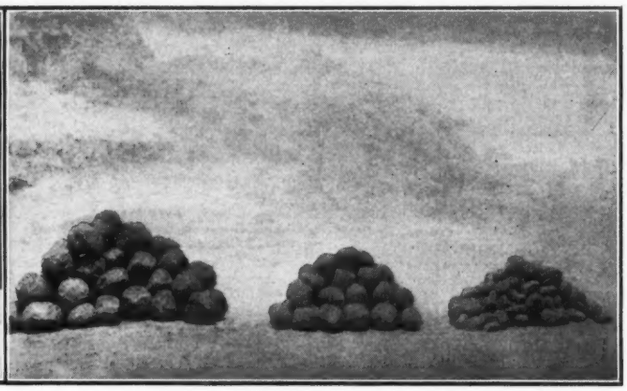


FIG. 2. FELSITE PEBBLES, CRUDE AND AFTER USE IN MILL

After the secondary cone was installed at the Lonely Reef mill, the underflow was returned to the sump of a centrifugal pump which elevated the battery pulp to a distributor supplying the tube-mill cones. The overflow from the secondary cone went directly to the Dorr thickeners.

The underflow discharge from the baffle cones was delivered into the tube-mill feed-boxes, where the material was picked up by the usual type of scoop feeder. Solution was added to reduce the specific gravity of the pulp, but it was found permissible to lower the moisture content below the usual percentage, the increase in power consumption being more than compensated for by the increase in tonnage ground.

*Metallurgical engineer, 309 Broadway, New York.

[1]"Rand Metallurgical Practice," Vol. I, p. 212.

The tube mills were all fitted with bell ends, an arrangement for which I have never been able to discern a single advantage. The original end-liner design was faulty, and a space was left into which gravel and small pebbles often found their way. Scouring of the mill-end then occurred, and breakage of the trunnions was a comparatively common occurrence. End liners were then designed of a thickness varying with the severity of wear, being about three times as thick at the junction of trunnion liner and end liner as at the internal periphery of the mill.

Tests on Types of Liners

The mills were originally designed for silex liners, set in magnesite. These proved hopeless. In addition to the need for constant repair, due to the collapse of one or more liner blocks, there was a material loss in duty as a result of the reduction in the effective diameter of the mill. The smoothness of the interior also detracted from grinding efficiency.

A number of full-scale tests were then carried out and comparisons made with various designs of metal lining. A Komata lining was installed in one of the mills and the speed reduced to satisfy the requirements of this particular type. It was found, however, that the reduction in speed resulted in a serious diminution in duty. Further investigations showed that the grade of product being handled (about 6 holes per square inch) was too coarse to be effectively slimed in a mill of this type at the reduced speed. By returning to a speed based on Davison's formula ($s = \frac{200}{d}$, where d = diameter in inches, and s = the r.p.m.) the Komata still showed a lower efficiency than other types.

At the same time a second mill was equipped with ordinary El Oro lining, and comparative tests were made between this and the Komata lining. The results were conclusive and led to the adoption of El Oro in both mills.

Further tests were made on a third mill with a type of lining known locally as the Osborne, in which steel strips a few inches wide, an inch or so thick, and the length of the mill, were placed alternately flat and edgewise around the inside of the mill. These were kept in position by a wedging action without bolts. The results, however, were not satisfactory, and the third mill was then equipped with El Oro liners. The latter are now made on the property from a special mixture, and are giving comparatively long life at a moderate cost.

As previously indicated, tube-milling practice on this property was designed along Rand lines. The original intention was, therefore, to use mine rock in place of pebbles as a regrinding medium in the tube mills. On the Rand a specially hard chert is generally available for this purpose, but the Lonely Reef ore was a friable quartz. Nothing more satisfactory was found in the mine, and it was only after considerable expense that any quantity of tube-mill pebbles could be obtained from this material. These fractured in quantity on being fed into the mill, and the production of large tonnages of chips and gravel resulted in very low output and grinding efficiency.

Mine rock of this description may serve in cases where the tube mill merely acts as a regrinder to produce a slightly finer product than is being sent out by the battery, but experience shows that pebbles of good quality are needed to slime efficiently a coarse-ore pulp.

Steps were then taken to find a suitable substitute for the mine rock, and a deposit of close-grained felsite, situated a few miles from the mine, was selected to produce the necessary material. Following along lines instituted in Mexico early in 1910, the rounded pebbles were hand-made under contract, with native labor, the average cost being about $5 per ton delivered at the mine. A double-ring gage was used to test the stones and to see that those delivered satisfied the contract requirements. This precaution insured that the maximum-sized pebble was fed to the mill without danger of choking the scoop feeder or trunnion intake.

In designing tube mills it is important to allow ample capacity in the scoop and trunnion diameters. In the case under review it became advisable to use a very coarse screen on the battery, and this required correspondingly heavy pebbles in the tube mill. It often occurs that the size of the pebble used is limited below the effective diameter on account of the smallness of the mill-feed entrance.

In order to test the work of the mills from every standpoint, a quantity of Danish flint pebbles was imported. The result was a diminution in output and a considerable rise in the cost of grinding. The hand-made felsite pebbles gave by far the best results, largely because of their uniformity in size and weight and the fact that they possessed a granular composition that resisted fracture.

Brazilian Zirkite Deposits

Some particulars of the Brazilian deposits of zirkite are noted, from a Brazilian periodical, in the *Chemical Trade Journal*, Feb. 3, 1917. The Caldas region, in which these deposits occur, is about 130 miles north of the City of São Paulo. Several large outcrops of the ore occur on the extreme westerly edge of the deposits, one or two isolated boulders weighing as much as 30 tons. No extensive development work has yet been attempted, although several crosscuts have been run to determine the width of the vein and a few shallow prospect holes to ascertain the depth. Deposits have been traced for 15 miles between Cascata and Caldas.

In some of the deposits the ore occurs in the form of gravel, and large pebbles embedded in a reddish clay matrix greatly resembling boulder clay. The clayey mass, on being exposed to the tropical sun and air, readily dries, and the zirconia can then be separated from the clay matrix by a coarse screen. Before shipment it is thoroughly washed to remove the small percentage of ferruginous matter still remaining.

Most of the mines are many miles from a railway, so that the ore has to be transported by ox carts carrying about one ton each. Owing to the mountainous character of the roads from 20 to 30 oxen are generally required for each cart.

Pipes of Electrolytic Iron—A firm at Grenoble in France, says a writer in "Iron and Coal Trades Review," Dec. 22, 1916, is now manufacturing pipes of electrolytic iron up to 5 m. (16.4 ft.) in length, 300 mm. (nearly 12 in.) diameter and 3 mm. (⅛ in. bare) thick. The metal as taken from the bath is hard and very brittle, but after a special and careful heat treatment becomes of excellent quality and has a tensile strength of over 25 tons per sq.in. in any direction. They are said to be superior to cast-iron pipes in several respects.

New East Rand Mines

By A. Cooper Key*

SYNOPSIS—Brakpan and Modderfontein have completed arrangements for the taking over of government areas for deep mining. Compensation is to be on a sliding scale of royalty that puts a premium on mining and metallurgical efficiency. Terms are favorable to operating companies and the government and it is assumed that as a result the possibility of future government mining will be removed.

The tenders accepted by the government of the Union of South Africa for the working of 1812 claims on Brakpan and the 651 claims on the Modderfontein are remarkably satisfactory from the government's point of view. The tender of the Brakpan mines also constitutes remarkably good business from that company's standpoint.

The Brakpan mines project is to amalgamate the tender block of 1812 claims with the property of that company, originally 1150 claims, of which about a quarter has been exhausted, and with 424 claims in Schapenrust. The Brakpan mine agrees to spend £850,000 in developing the area and in doubling its reduction plant.

The Sliding-Scale Formula Used To Pay Government

The consideration to be paid to the government in addition to profits tax (and war levy as long as imposed) is 5% of the profits of the amalgamated property for the first five years and thereafter a percentage calculated on the sliding scale according to the formula, $50 - \frac{1150}{X}$, X being the percentage that the net produce bears to the recovery. This is the general formula devised by Mr. Kotze, the government mining engineer, and given in the memorandum on the Far East Rand, which was summarized in the *Engineering and Mining Journal,* Sept. 30, 1916. It provides that while the government gets a greater share of the profits when these increase owing to higher grade, they should not rise unduly when profits are increased by a reduction of costs. Otherwise, as in the case of the Modder Areas lease, efficiency would be penalized. These objects can best be attained by calculating the government's share of profits in accordance with the general formula, $y = a - \frac{b}{x}$, in which y is the percentage payable to the government, and a and b are constants. In the Brakpan mines tender a becomes 50 and b becomes 1150. These appear to be round numbers, but they are the outcome of exhaustive engineering calculation and investigation. The 1150 is by a curious coincidence the original number of claims of Brakpan, but it has, of course, no possible connection. The sliding scale begins with a minimum of 12½%. This minimum is reached where the profits represent 31% of the production. At 35% ratio of profit to recovery, the amount payable on the sliding scale would be: $50 - \frac{1150}{35}$, or $50 - 33 = 17\%$.

*Box 3621, Johannesburg, South Africa.

The amount payable to the Union government works out as shown in the accompanying table:

TABLE SHOWING PERCENTAGE OF GOVERNMENT ROYALTY

Ratio of Profit to Product, %	Ordinary Profits Tax, %	Sliding Scale of the Net Produce, %	Ordinary Royalty, %	War Levy, %	Total Royalty, %
30 and under	10	12½ (min.)	22½	5	27½
32½	10	14½	24½	5	29½
35	10	17	27	5	32
37½	10	19½	29½	5	34½
40	10	21½	31½	5	36½
42½	10	23	33	5	38
45	10	24½	34½	5	39½
47½	10	26	36	5	41
50	10	27	37	5	42

It must be remembered that this sliding scale does not begin to be operative until after the five years (the period required for developing the new area presumably) have elapsed, by which time—indeed, long before—it is hoped that there will be no necessity for a war levy. This, however, brings the period to 1921, before which several of the Rand outcrop mines will have become worked out; by 1924 it is calculated that only 33 of the existing 58 companies will be working. Based upon past experience of South African public finance, it would certainly be unwise to count upon any lightening of the burden. If not a war levy, it would be some other sort of levy.

Is the Brakpan tender better than that of the Modder Areas (Barnato Bros.)? It is difficult to give an answer to this question, inasmuch as the latter applied to virgin ground, whereas in the present instance the government participates immediately in the profits of an established mine as well as in other ground to the south (Schapenrust). It shares in two extraneous areas. During 1916 Brakpan crushed nearly 3,600,000 tons, and by the time the sliding scale becomes operative, this quantity can easily be increased to 8,000,000 tons, assuming that the additional crushing capacity is brought into operation gradually. Taking very rough figures, this would mean that two-thirds of the original Brakpan area had been exhausted. Making allowance for this factor, the combined unworked area would be rather less than 2600 claims. In five years the government will be receiving a minimum of 22½% of the profits eventually won from 2600 claims as consideration for the right to work 1812 claims (the area to be leased), which is equal to about 32% in respect of the leased area, viewed separately. Taking the recovery at 27s. and costs at 18s., the royalty would be 25% with profits tax and 30% with both profits tax and war levy. It is evident with the acceleration of crushing at Brakpan (to which there are of course practical limits) the importance of the existing Brakpan mines area as a factor, diminishes.

The Modderfontein 17 Tender

The tender accepted for the 651 claims on Modderfontein No. 17 proposes amalgamation with the Rand Klip and Cloverfield mines and the ultimate provision of £1,184,000, the consideration to be paid to the government in addition to profits tax (and presumably war levy) is 10%; that is, a total of 20% including profits tax or 25% including profits tax and war levy. As no ore has been milled from this area of 2450 claims and there is no sliding scale, comparison and analysis are simpler. The new company is to give the government

10% of the total profits from the whole area. This is made up of 1000 claims of the Rand Klip, 800 claims of Cloverfield mines and the 651 government-lease claims, or 2451 claims in all. It will be observed that the leased area is little more than a quarter of the whole, and this fact combined with the flat rate gives a very high proportion when worked out on the leased area itself. If the calculation be based on profits tax alone, the new company is paying 47.7% of the net produce of the government ground; if it is reckoned on the war levy as well, the rate comes to over half, or 52.6%. Whether the rate of profit per ton be high or low—and this is of course the crucial point in relation to remuneration as capital—the government will receive about half less with profits tax only, more if war levy or its equivalent be continued. In the original lease for ground in the Far East Rand, Modder State mines, the lower royalty would be reached only when the ratio of profits to recovery was 41%, while at the higher royalty the ratio would be nearly 45%. It has long been contended by the controllers of this property that the lease is inequitable in its tax.

The extraordinarily high terms offered, are all the more surprising in view of the evidence given by E. A. Wallers, manager of the Central Mining and Investment Corporation, the successful tenderer before the Select Committee on East Rand gold areas in April, 1916. The Central Mining and Investment Corporation guarantees to subscribe £350,000, while if the options are exercised by that corporation, the two constituent companies and the creditors of Cloverfield, the amount will be increased to £1,184,000. It may be recalled that the government's estimate of the preliminary capital required was at least £300,000 if the ground was worked as an entirely independent proposition. The further sum of £300,000 was estimated as required to bring the property to the full producing stage. It will be seen that the ultimate amount contemplated under the scheme is virtually double, but then, of course, the mining area is nearly four times as great. All these years the Rand Klip and Cloverfield have been unable to reach the producing stage, and one pauses to consider how matters can be changed by liability to give the Union government a much larger share of the profit derivable from these areas; that is, over 17% against the ordinary profits tax of 10%.

What the Royalty Means for the Area Itself

If we take costs at 17s. per ton (this property will not be a very deep one), the recovery would have to be 32s. if the ratio of profit to production were 47%, the effective royalty on the 650 lease claims. At that point the Modder State mines would have to pay 55%, but on the Clover Klip project there is no sliding scale. Can it be that there is sufficient ore above the average value to justify such a high flat rate? It may be recalled that the government mining engineer, in evidence before the Eastern Area Select Committee, said he thought one of the reasons why no tenders were forthcoming for the earlier offer of Brakpan was that the minimum terms asked were a little bit too high. That minimum was 10%, and up to 30% the royalty was the same as the ratio; thereafter the curve flattened, and with a ratio of 60% profits to recovery, the percentage of profit was but 45. Now we have a flat rate offered which is in effect in excess of the latter maximum; the tender is much better than the government advisers ever hoped to get. When the mining groups of the Rand are prepared to give such terms as those for the Brakpan and Modder leases, why should the government consider state exploitation for a moment? The offers are deemed to have killed any idea of state mining.

Hoover—Belgium

Our esteemed contemporary *Life* has always been appreciative of our friend Hoover. These are its latest remarks:

Hoover is here! Hoover; Herbert C., the Reliever.

He is here about Belgium and relief. He is here with both feet. He wants Belgium relieved at once on a large continuous scale, and wants us to do it; he says we ought to do it; that it is our job; that the Belgians mostly think we are their chief relievers, whereas the truth is that of $250,000,000 spent for Belgian relief up to Jan. 1, 1917, we gave $9,000,000; and Hoover says we made $30,000,000 on the supplies we sold.

No doubt these are true figures, but Hoover does not quite do us justice, in that he has omitted to mention our greatest gift to Belgium. We haven't given her much money, but we gave her Hoover! So we claim. Maybe Hoover thinks *he* gave Hoover. He might make out a case for that, but if he does, it will leave our case looking very sick, for we have had much credit for Belgian relief and have not given much money. What Hoover has done, and the Americans who have worked with him, is the main part of what the Belgians thank us for. Hoover will protest at this and probably insist that he has not done more than others, and it is true that he has had good helpers; but if you go to the helpers to find out the truth about it, they will tell you, "Hoover!"

The papers say the British appreciate Hoover and wanted to naturalize him. But he declined. He does not wish to be naturalized in England nor lionized here. What he wants is *money;* money for Belgium! He thinks we should pay in for Belgium at least $6,000,000 a month. That would meet about one-third of Belgium's monthly needs.

Send the money to the Belgium Relief Commission, 120 Broadway, New York.

Keep on sending it; a little at a time if more convenient, but preferably a good deal at a time, for $6,000,000 a month is quite a bit of money. If we get into the war, of which, at this writing there is a cheering prospect, our Government may undertake part of this duty, unless, indeed, the German blockade has the power and the disposition to stop all transportation of relief. Mr. Hoover thinks Belgium relief will not be affected by the new blockade, as the Commission's ships now have passes from all the belligerents. Anyhow, the Commission's ships will sail as usual until further notice, and money must continue to be provided to load them.

So send it in!

United States Production of Strontium Ore

For the first time in many years strontium ore has been marketed from deposits in the United States, according to J. M. Hill, in bulletin of the United States Geological Survey. Most of the ore marketed in 1916 was produced in Arizona and California. The domestic output was about 10% of the ordinary demand, which amounts to 2000 tons.

Preliminary Report of the Mineral Production of Canada for 1916

The preliminary report on the mineral production of Canada, during the calendar year 1916, prepared by John McLeish, chief of the division of Mineral Resources and Statistics, has been issued by Dr. Eugene Haanel, director of the Department of Mines.

The war had a most pronounced effect in stimulating the production of nickel, copper, and zinc, iron and steel, molybdenum, etc., used so extensively for war purposes, and also in increasing the production of other products such as chromite and magnesite. The general industrial activity in metallurgical operations and in the manufacture generally of munitions of all kinds, including the freight movements required, increased the demand for fuel, which was met in Western Canada at least by large increases in coal production.

Considerable progress was made during the year in establishing and increasing smelting and refining capacities, of which the installation of electrolytic zinc and copper refineries at Trail and the beginning of construction of a nickel refinery at Port Colborne, Ont., are conspicuous examples. In addition, mention should be made of the production of metallic magnesium at Shawinigan Falls, of ferromolybdenum at Orillia and Belleville, of metallic arsenic at Thorold, and of stellite, the cobalt alloy for high-speed tool-metal, at Deloro, and of the increased capacity for the production of steel.

THE MINERAL PRODUCTION OF CANADA, IN 1916

(Subject to Revision)

Product	Quantity
Metallic:	
Antimony ore (exports), *tons	794
Cobalt metallic and contained in oxide, etc., lb	841,859
Copper, lb	119,770,814
Gold, oz	926,963
Iron pig from Canadian ore, tons	115,691
Iron, ore sold for export, tons	140,608
Lead, lb	41,593,680
Molybdenite, MoS_2 contents, lb	159,000
Nickel, lb	82,958,564
Platinum, oz	15
Silver, oz	25,669,172
Zinc, lb	23,515,030
Nonmetallic:	
Actinolite, tons	250
Arsenic, white, tons	2,186
Asbestos, tons	136,016
Asbestic, tons	18,500
Chromite, crude ore†, tons	27,030
Coal, tons	14,461,678
Corundum, tons	67
Feldspar, tons	19,166
Fluorspar, tons	1,284
Graphite, tons	3,971
Grindstones, tons	3,328
Gypsum, tons	341,618
Magnesite, tons	55,413
Manganese, tons	979
Mica, tons	914
Mineral pigments—	
Barytes, tons	1,368
Oxides, tons	8,811
Mineral water	
Natural gas, M cu.ft	25,238,568
Peat, tons	300
Petroleum, bbl	198,123
Phosphate, tons	203
Pyrites, tons	309,411
Quartz, tons	135,803
Salt, tons	124,033
Talc, tons	10,651
Tripolite, tons	620

* Tons of 2,000 pounds.

† Ore and concentrates finally marketed estimated as 13,834 tons.

The mining output was restricted and the efficiency of operation considerably reduced by the withdrawal for war service of such a large proportion of the more experienced labor and engineering supervision. Higher costs offset advantages derived from higher prices of output and in the case of gold mining were a distinct burden.

There was an increased production of nearly all metals with the exception of lead and silver.

Gold

The total production of gold in placer and mill bullion and in smeltery production in 1916 is estimated at 926,963 fine ounces valued at $19,162,025 as compared with 918,056 fine ounces valued at $18,977,901 in 1915, an increase of $184,124, or about 1 per cent. It is the largest production since 1902. The highest production recorded was $27,908,153 in 1900, and the lowest since then was $8,382,780 in 1907.

Of the total production in 1916, 26% was derived from placer and alluvial mining; 54% from bullion and refined gold, and 20% contained in matte, blister copper, residues and ores exported.

The production in Nova Scotia was about $103,359, a decrease from 1915 due to water shortage which interfered seriously with the operations of the hydro-electric plants. The production in Quebec is derived from the pyrites ores of the Eastern Townships. The gold content of these ores is very low and is not paid for to the mine operators.

Ontario, since 1914, has been the largest gold-producing province in Canada. The production for 1916 was 489,679 fine ounces, being 52.8% of the total production for Canada and an increase of 20.4% over that of 1915 and 82% over the production of 1914. The Hollinger Consolidated mines contributed about 48% of the output and the Dome about 21%.

Apart from a very small recovery of alluvial gold in Alberta no production is recorded from this province nor from Manitoba or Saskatchewan. The production in British Columbia was $4,520,868, as against $5,651,184 in 1915, a decrease of 20%; this total includes $575,000 estimated by the provincial mineralogist as being the output of placer mining, and $3,945,000 recovered from milling and smelting operations. The production from the Yukon Territory amounted to $4,391,669, as against $4,750,450 in 1915, a decrease of 7.5%, and was derived from the alluvial deposits with the exception of about $9000, which was produced from the gold and copper ores of Whitehorse and the silver-lead ores of the Silver King mine near Mayo. The exports of gold-bearing dust, nuggets, gold in ore, etc., in 1916 are reported by the Customs Department as $18,382,903.

Silver

The production of silver in 1916 was 25,669,172 fine ounces, as gainst 26,625,960 fine ounces in 1915, a decrease of 3.6%. The production in Ontario amounted to 21,975,942 oz., or 85.6% of the total production for Canada. The production from the ores of Cobalt and adjoining silver camps was 21,885,057 oz., including 18,418,392 oz. in bullion recovered in smelteries and reduction plants in Canada and 3,466,665 oz. estimated as recovered from ores exported to the United States smelteries; thus 84% being recovered as bullion in Canada: of this bullion, 9,665,516 oz. was recovered in Southern Ontario smelteries and 8,752,876 oz. in Cobalt mills. The balance, 90,886 oz., was the output of gold and copper mines.

The production in Quebec was about 97,000 oz. derived from pyritic ores of the Eastern Townships and the zinc-lead ores of Notre Dame des Anges.

In British Columbia the production was 3,235,764 oz., as against 3,565,852 oz. in 1915, a decrease of about 9%. This production includes refined silver, silver contained in smeltery products and estimated recoveries from ores exported.

The Yukon production was 360,466 oz., as against 248,049 oz. in 1915, an increase of about 45%. The 1916 production included 47,703 oz. derived from the placer operations; the balance was the product of the gold and copper mines of the Whitehorse district and the high-grade gold-silver-lead mines of Mayo.

The exports of silver bullion and silver in ore, etc., as reported by the Customs Department were: 25,279,359 oz., as against 27,672,481 oz. in 1915.

Copper and Nickel

The production of copper has shown large increases during the last three years. In 1916 the total copper contents of smeltery products credited to Canadian ores and estimated recoveries from ores exported amounted to 119,770,814 lb.; production in 1915 was 100,785,150 lb. There was thus an increase in 1916 of 18,985,664 lb., or 18.8%.

Of the total 1916 production 92,763,603 lb. was contained in blister copper and in matte, and 27,007,211 lb. estimated as recovered from ores exported. In addition to the recoveries from domestic ores there was also recovered by British Columbia smelters 5,551,166 lb. of copper from imported ores. An electrolytic copper refinery, installed at Trail, began active operations about Nov. 1 with a capacity of 10 tons of refined copper per day.

The production in Quebec from pyrite ores was 5,707,200 lb., as against 4,197,482 lb. in 1915. These are the quantities reported as being paid for; the actual content was much higher.

The Ontario production was derived chiefly from the nickel-copper ores of the Sudbury district and of the Alexo mine in Timiskaming, supplemented by a small recovery from the Cobalt district silver ores and by shipments made from six copper properties under development. The total production in 1916 was 44,997,035 lb., as against 39,361,464 lb. in 1915, an increase of 12.5%.

The British Columbia production was 65,086,119 lb., as compared with 56,692,988 lb. in 1915, an increase of 14.8%. The 1916 production in this province included 47,904,282 lb. recovered in blister and matte and 17,181,837 lb. recovered from ores shipped to United States smelters. The Coast mines, including the Britannia, Texada Island and Anyox mines, together with the shipments from Hazelton, were credited with 43,048,065 lb. and the Trail Creek and Boundary mines with 22,038,054 lb. The increase in 1916 was entirely from the Coast properties.

The high price of copper stimulated production from the Whitehorse district of the Yukon. Complete returns have not yet been received, but the ore shipments were approximately 49,000 tons, with a recoverable copper content estimated at 3,980,640 lb. In 1915 the production from this source was 533,216 lb.

Exports of copper according to customs records were: Copper fine in ore, matte, regulus, etc., 124,942,400 lb.; in pigs, bars, sheets, etc., 2,430,400 lb. There were also exports of old and scrap copper amounting to 5,846,600 lb.

The production of nickel in 1916 was, as usual, derived from the ores of the Sudbury district supplemented by the recovery of a small quantity of metallic nickel, nickel oxide and other nickel salts as byproducts in the treatment of ores from the silver-cobalt-nickel ores of the Cobalt district. The total production was 82,958,564 lb., as against 68,308,657 lb. in 1915, an increase of 21.5%.

The nickel-copper ore, derived from nine separate mines in the Sudbury district, together with a small tonnage of similar ores from the Alexo mine in Timiskaming, was reduced at Copper Cliff and Coniston to a 77 to 82% matte and shipped in that form to Great Britain and the United States for refining, the product of the Canadian Copper Co. going to New Jersey and that of the Mond Nickel Co. to Wales. A refinery is now under construction at Port Colborne, Ont., by the International Nickel Co., in which a portion of the matte produced by the Canadian Copper Co. will be refined. Although not shipping during the year, the British America Nickel Corporation, Ltd., was actively engaged in the development of its nickel properties in the Sudbury district and in the erection of a smeltery.

The total production of matte in 1916 was 80,010 tons, containing 44,859,321 lb. of copper and 82,596,862 lb. of nickel. The tonnage of ore smelted (part being previously roasted) was 1,521,689 tons.

Nickel was recovered as a byproduct in smelteries at Deloro, Thorold and Welland, from the silver-cobalt-nickel ores of the Cobalt district, the total nickel contents of nickel oxide, nickel sulphate and metallic nickel produced being 361,701 lb. The products recovered included 79,360 lb. of metallic nickel, 323,418 lb. of nickel oxide and 232,450 lb. of nickel sulphate.

The following table shows the production of nickel by smelters in the Sudbury districts, the exports from Canada and United States records of imports and exports:

PRODUCTION OF NICKEL IN CANADA

	1912 Tons *	1913 Tons *	1914 Tons *	1915 Tons *	1916 Tons *
Ore mined	737,584	784,697	1,000,364	1,364,048	1,566,333
Ore smelted	725,065	823,403	947,053	1,272,283	1,521,689
Bessemer matte produced	41,925	47,150	46,396	67,703	80,010
Copper content of matte	11,116	12,938	14,448	19,608	22,450
Nickel content of matte	22,421	24,838	22,759	34,039	41,298

EXPORTS OF NICKEL FROM CANADA

	Lb.	Lb.	Lb.	Lb.	Lb.
Nickel contained in matte, etc.:					
Exported to Great Britain	5,072,867	5,164,512	10,291,979	13,748,000	11,136,900
Exported to United States	39,148,993	44,224,119	36,015,642	52,662,400	69,304,800
Exported to Other Countries	.....	70,386	220,706	.....	.....
	44,221,860	49,459,017	46,538,327	66,410,400	80,441,700

* In tons of 2,000 lbs.

Lead

Notwithstanding the demand and high prices, the actual recovery of lead as bullion and refined was less than during 1915. The total production in 1916 of lead in bullion credited to Canadian mines and estimated as recoverable from ores exported was 41,593,680 lb., a decrease of over 10%. The 1916 production included 38,838,372 lb. of lead in bullion, of which a large portion was electrolytically refined, and 2,755,308 lb. recoverable from ores exported. The lead bullion was produced chiefly at Trail with small contributions from smelters at Kings-

ton and Galetta, Ont. The lead ores exported were derived from Notre Dame des Anges, Que.; Hollandia mine, Bannockburn, Ont.; Surprise mine, Slocan, B. C.; and the Silver King mine, Mayo, Yukon district.

Although the recoveries of lead were small in 1916, shipments of lead ores from mines appear to have been greater than in the previous year. Lead-ore shipments in 1916 were approximately 82,000 tons, containing 51,083,000 lb. of lead, while zinc-lead ores shipped to Trail contained considerable quantities of lead which would be recoverable in large part after the extraction of the zinc.

Zinc

With the exception of a small production in experimental work, there was no production of refined zinc in Canada previous to 1916. The establishment of an electrolytic zinc refinery at Trail, and of a zinc recovery plant at Shawinigan Falls, has placed the metallurgy of this metal in Canada on a similar basis to that of lead and copper.

In 1916 the total zinc-ore shipments from mines, including the zinc-lead ores from the Sullivan mine and ores exported, were about 80,965 tons, containing 47,243,575 lb. of zinc (partly estimated in the absence of complete returns). A portion of the ores shipped to Trail were not treated during the year, and the percentage of zinc recovered at the Trail refinery in the early stages of operation was probably not so large as will be secured when primary difficulties have been eliminated. Adding to the actual recovery of refined zinc at Trail 80% of the zinc contents of ores sent to the United States smelteries, there was a zinc production of 23,515,030 lb. Of the total production, 1,774,080 lb. was credited to the Notre Dame des Anges ores in Quebec, and 21,740,950 lb. to British Columbia.

Cobalt

Cobalt is being recovered at the smelteries at Deloro, Thorold and Welland, Ont., in the form of metallic cobalt, cobalt oxide, cobalt sulphate and other salts and also stellite, the cobalt alloy used for high-speed tool metal, from silver-cobalt-nickel ores of the Cobalt district. Some cobalt residues from the Nipissing mill were also shipped to Great Britain. The total production of cobalt contained in smeltery products recovered and in cobalt residues exported during 1916 amounted to 841,859 lb. The 1916 production included 215,215 lb. of metallic cobalt.

Molybdenum

The demand for molybdenite resulted in considerable exploration of known occurrences and the development of several properties of considerable promise. Shipments were made during 1916 from at least 17 different localities in Quebec, Ontario and British Columbia, of which that at Quyon, operated by the Canadian Wood Molybdenite Co., was the most important. Most of the ores produced were shipped for concentration to the International Molybdenum Co.'s mill at Renfrew, or the concentrating plant operated by the Mines Department at Ottawa. Some ores were also shipped by the Canadian Wood Molybdenite Co. for concentration in Denver; this company also built a mill near the mine at Quyon and a second mill at Hull, Que. A concentrating mill was built by the Renfrew Molybdenum Mines Co. at Mt. St. Patrick.

The total MoS_2 contents of concentrates produced and shipped during the year was about 159,000 lb., for which the official price paid was 105s. per unit of MoS_2 at Liverpool. A portion of the concentrates were used in the manufacture of molybdic acid, and ferromolybdenum at Orillia, Ont. Ferromolybdenum is also now being made at Belleville, Ont. The Imperial Munitions Board, Ottawa, is an agent for the purchase in Canada of molybdenum for the British government.

Iron Ore

Iron-ore mining operations were confined to the Helen and Magpie mines of the Algoma Steel Corporation in the Michipicoten district of Ontario, together with a small production of ilmenite at Ivry-on-the-Lake, Que., by the Manitou Iron Mining Co. There was also a shipment of concentrates from the concentrator at Trenton, Ont., produced in previous years from ores derived from the Bessemer and Childs mines in Hastings County. The total shipments in 1916 were 339,600 short tons, as compared with 398,112 tons in 1915. Shipments of iron ore from Wabana mines, Newfoundland, in 1916 by the two Canadian companies operating there were 1,012,060 short tons, all of which was shipped to Cape Breton.

The total production of pig iron in 1916, not including the output of ferroalloys, was, according to complete returns now received, 1,169,257 short tons (1,043,979 long tons). The 1916 production was greater than that of any previous year, the second largest production of pig iron having been 1,128,967 short tons in 1913.

The blast-furnace plants operated were the same as in the previous year, viz.: the Dominion Iron and Steel Co., at Sydney, N. S.; the Nova Scotia Steel and Coal Co., at North Sydney; the Standard Iron Co., at Deseronto, Ont.; the Steel Company of Canada, at Hamilton, Ont.; the Canadian Furnace Co., at Port Colborne, Ont.; and the Algoma Steel Corporation, at Sault Ste. Marie, Ont.

The production of ferroalloys in Canada in 1916, chiefly ferrosilicon, but including also ferrophosphorus and ferromolybdenum, all made in electric furnaces, was 28,628 tons.

Asbestos and Chromite

The asbestos industry was particularly active during 1916, the value of the production having been the highest on record, though the quantity was slightly exceeded in 1913. Stocks on hand at the end of the year were reduced to a minimum. Production, as usual, was confined to the asbestos district of Black Lake, Thetford, Robertsonville, Danville, and East Broguhton, in the eastern townships, province of Quebec

OUTPUT AND VALUE OF ASBESTOS 1915 AND 1916

	1915		1916	
	Crude	Milled	Crude	Milled
Output, tons	3,987	102,572	5,414	112,832
Sold, tons	5,370	105,772	5,893	130,123
Value, tons	$1,076,297	$2,476,869	$1,867,064	$3,266,268
Average per ton	$200 43	$23.42	$316.82	$25.10

The total output in 1916 was 118,246 tons which, compared with 106,559 tons in 1915, shows an increase of 11%.

Stocks on hand Dec. 31, 1916, were reported as only 6081 tons, as compared with 24,345 tons Dec. 31, 1915, and 31,171 tons Dec. 31, 1914. Sales of asbestic in 1916 were 18,500 tons.

The total quantity of asbestos rock sent to mills during the year was 1,822,461 tons, from which was obtained 112,832 tons of fiber, or an average recovery of 6.20%.

The total shipments of crude chromite ores in 1916 were 27,030 tons. These ores contained a total of approximately 6574 tons of Cr_2O_3 or an average of about 24%. A considerable portion of the low-grade ore and sand, however, amounting to 14,242 tons, was sent to concentrating mills for concentration before being marketed. The quantity thus concentrated was 10,992 tons, from which were recovered, 1046 tons of concentrates, averaging from 42% to over 50% Cr_2O_3. The final shipments of ore and concentrates approximated 13,834 tons. Practically the entire production was obtained in the district tributary to Thetford and Black Lake, in the Eastern Townships, Quebec.

Manganese and Gold in Brazil

Increasing interest in the manganese mines of Brazil is evident in the accompanying statistics of production for the last five years, as reported by the Brazilian Bureau of Commercial Statistics and published in the *Jornal do Commercio,* Feb. 1, 1917. The increase in the production of manganese ore, following the cutting off of European supplies is noteworthy; 1915 registered a marked increase over the previous year, and notwithstanding this stimulation, the 1916 production was nearly double that of 1915 in tonnage and almost tripled it in value, the 503,130 tons being valued at Rio de Janeiro at about $7,180,000, or more than $14 per ton. The gold output has been practically stationary for several years, but a North American syndicate is just now considering the development of another gold mine in the old Ouro Preto district.

MANGANESE AND GOLD IN BRAZIL

Year	Manganese Ore Metric Tons	Gold Kg.
1912	154,870	4,027
1913	122,300	3,393
1914	183,330	4,051
1915	288,671	4,565
1916	503,130	4,378

Refining of Georgia Kaolins

For years American manufacturers of tile and white ware have been dependent on the importation of foreign kaolin, chiefly in the form of English china clay, for their high-grade material. In 1916 there was 229,093 tons of kaolin imported. At the same time there were known to be available in Georgia and South Carolina large quantities of kaolin of a high degree of purity, except that it had an abnormal shrinkage and contained certain color-giving minerals, especially iron and titanium compounds. Heretofore this material has been available only for the paper trade and for some lower grades of pottery. Investigations carried on by Ira E. Sproat, of the Bureau of Mines, the results of which have been published as Bulletin 118, entitled "Refining and Utilization of Georgia Kaolins," show that the impurities may be readily and cheaply separated and the kaolin so modified in its physical characteristics, both as to shrinkage and to the development of color on burning, that it is comparable with the best English fireclay for many pottery purposes.

As a result of his investigation he concludes that a commercial vitreous china body could not be obtained by the direct substitution of refined Georgia kaolin for English china clay, but the fluxes had to be increased to obtain the desired degree of vitrification. However, the substitution of treated Georgia kaolin for all the ball clay and 50% of the English china clay produces a body of good working qualities and as good a color as the whitest commercial ware and of a far better color than most vitreous chinaware on the market.

He found also that Cornwall stone makes a stronger body than feldspar, but a feldspar wall-tile body can be made that is as strong as any commercial wall tile on the market, provided that the total clay content is at least 52%, of which 10% is ball clay and the other 42% is treated Georgia kaolin.

For the Relief of British Engineers

The families of many professional men in Great Britain are experiencing privation such as they have never before been called upon to face. This is not true only as regards families of those at the front, but also as regards families of many who are excused from active service because of age or physical disability, but who find themselves in need owing to the fact that they no longer are able to earn an income in the practice of their professions. For example, an architect in England to day has practically no possibility of professional employment, except in governmental work, as the construction of buildings, except those required for government purposes or specifically authorized by the government, is not permitted.

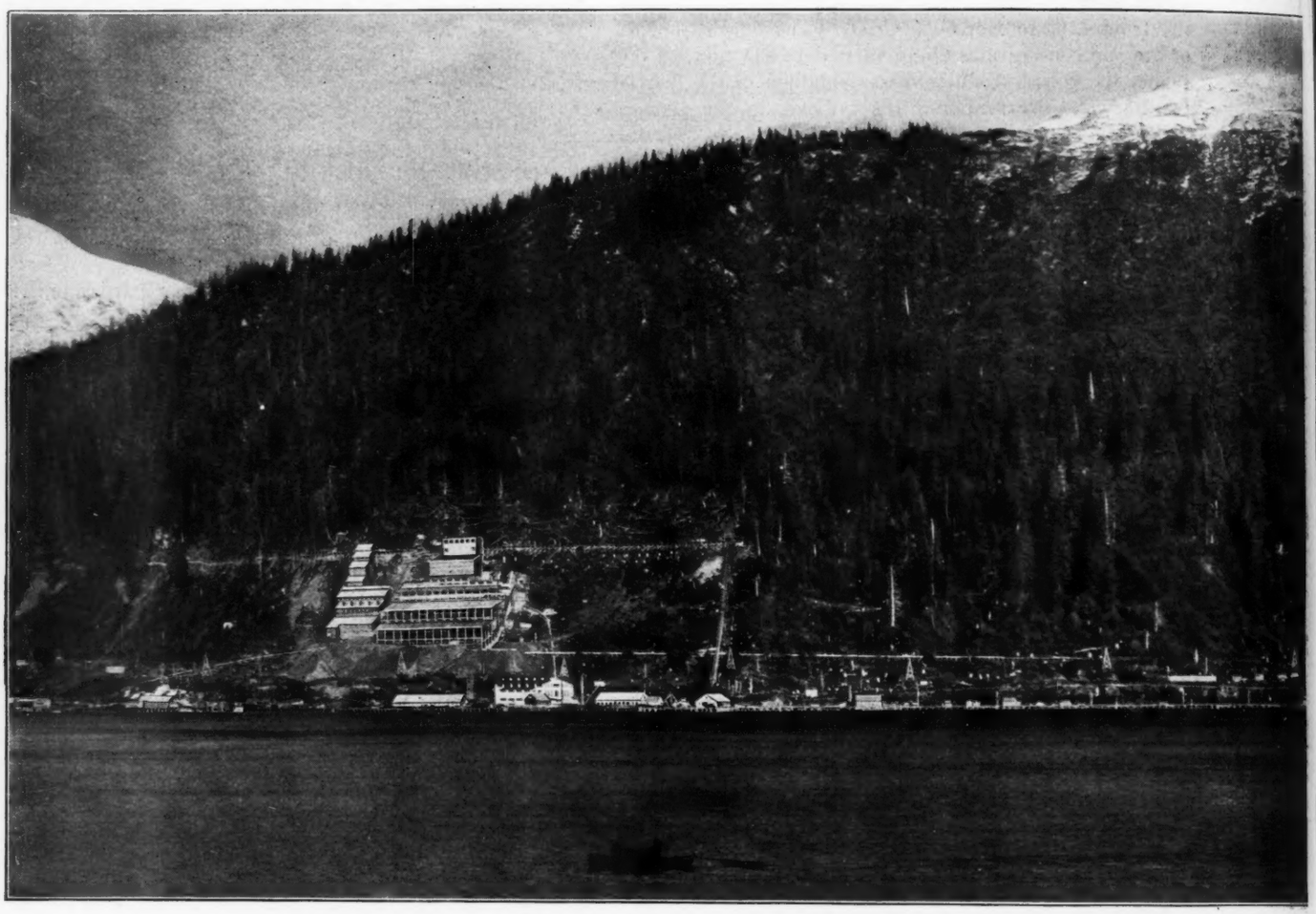
To relieve the resulting hardships and distress, the Professional Classes War Relief Council, Inc., was organized in Great Britain shortly after the outbreak of the war. Major Leonard Darwin, a son of the great naturalist, is chairman of the council. Jerrard Grant Allen is now in America representing the council, and independent investigation has confirmed his statements in respect not only of the need which exists, but also in respect of the organization and methods of the War Relief Council.

J. Pierpont Morgan has lent to the council his house in Prince's Gate for use as a maternity hospital. Births in this institution last year numbered approximately 300. At the present time the council is disbursing about $5000 per week, and the administrative expense, which is limited to compensation of subordinate employees, amounts to less than 2% of the money distributed. The council directs its activities largely along lines which provide relief by finding temporary employment for those whose accustomed way of earning a living is cut off, but in many cases pecuniary help is necessary.

The committee appeals to American engineers to demonstrate their sympathy by contributing to this worthy object. It is hoped that practically every American engineer will contribute at least $5, and contributions of this amount will be most welcome, as it is desirable that the engineering profession in America be represented by the largest possible number of contributors. Larger amounts also will be highly appreciated. Contributions may be forwarded to Lewis B. Stillwell, treasurer, care the Farmers' Loan and Trust Co., 475 Fifth Ave, New York.

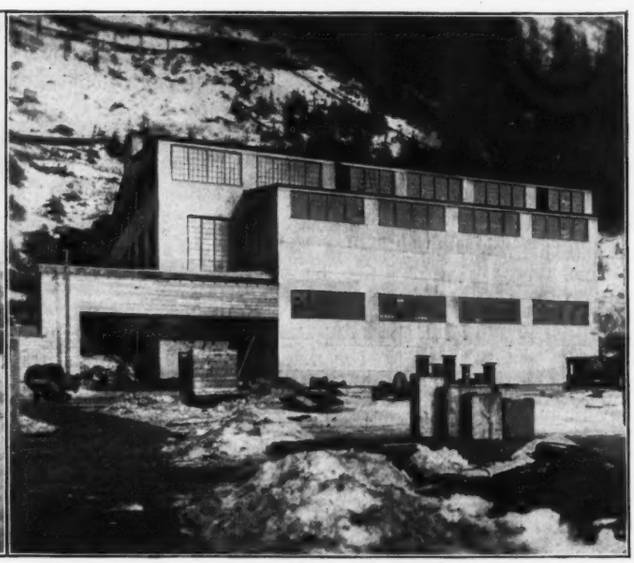
The Production of the Zinc Mines of Tonkin in 1916 is reported by "Echo des Mines" as follows: Société Minière du Tonkin, 17,600 metric tons (presumably selected ore or concentrates); Mines de Cho-Dien, 8000 tons; Société de Trang-Da, 7200 tons; Société de Yen-Linh, 3000 tons; Société de Thanh-Moi, 2900 tons.

Alaska Juneau's New Mill



PANORAMA OF THE NEW MILL AND SUBSIDIARY BUILDINGS OF THE ALASKA JUNEAU GOLD

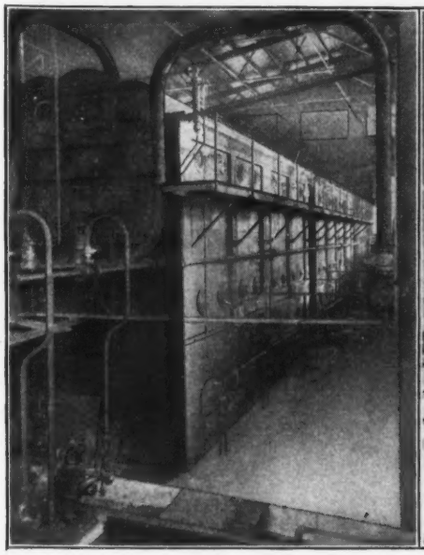
POWER HOUSE LOOKING EAST FROM MILL



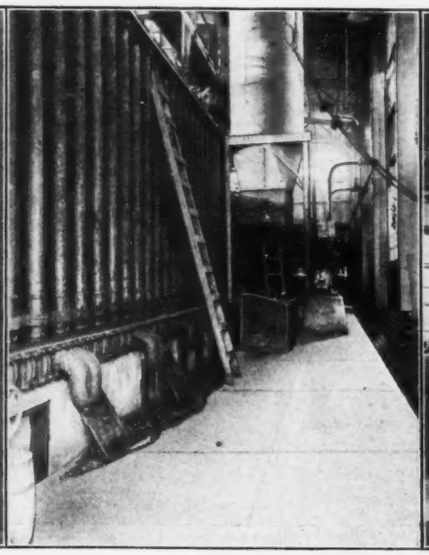
POWER HOUSE LOOKING NORTH FROM DOCK

on Gastineau Channel, Alaska

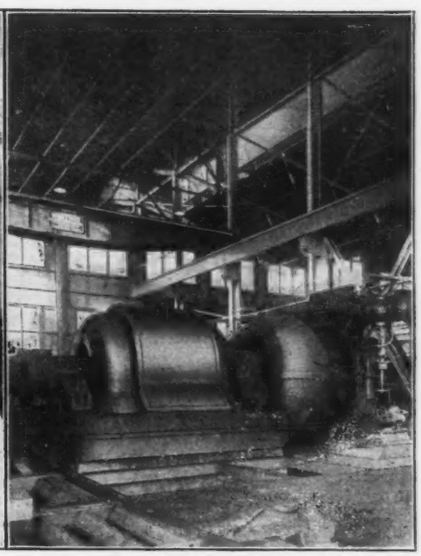
MINING CO., NEAR JUNEAU ON THE GASTINEAU CHANNEL, OPPOSITE DOUGLAS ISLAND, ALASKA



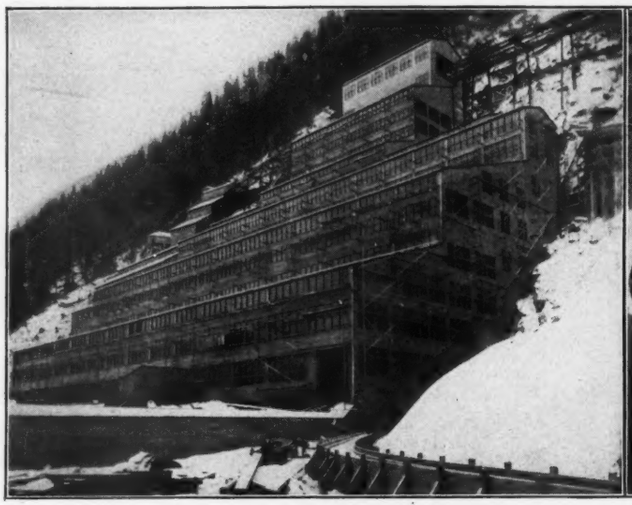
ALASKA JUNEAU BOILER ROOM



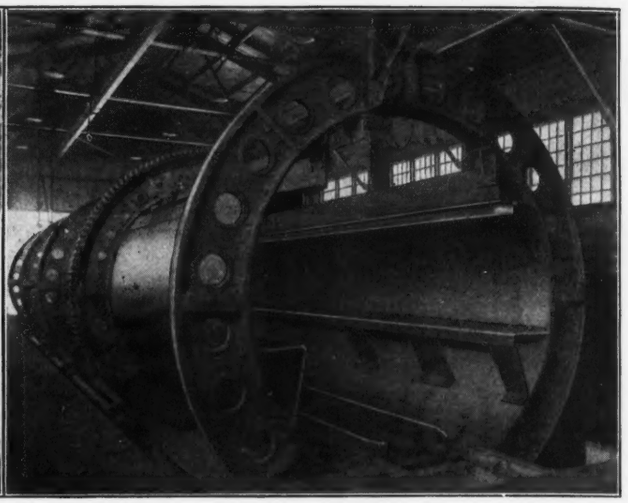
ECONOMIZER ROOM



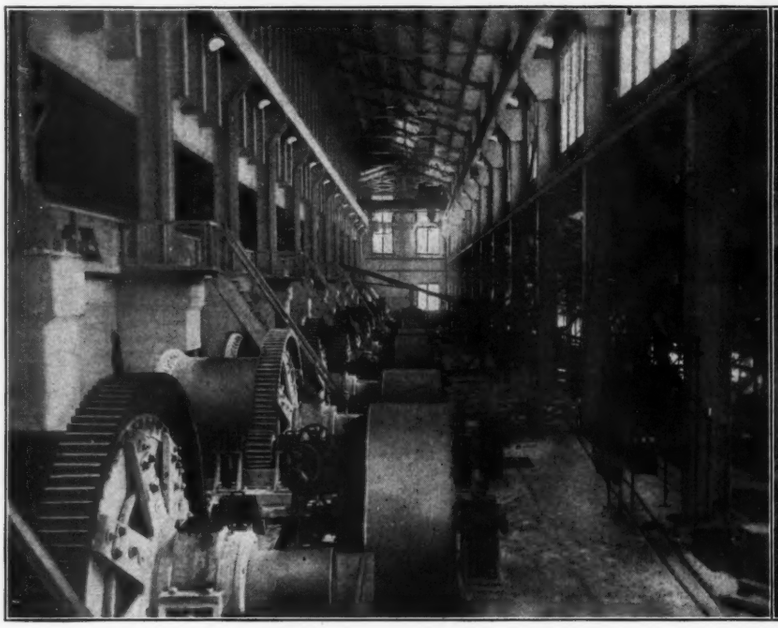
TURBINE FLOOR



Alaska Juneau mill—taken Jan. 1, 1917

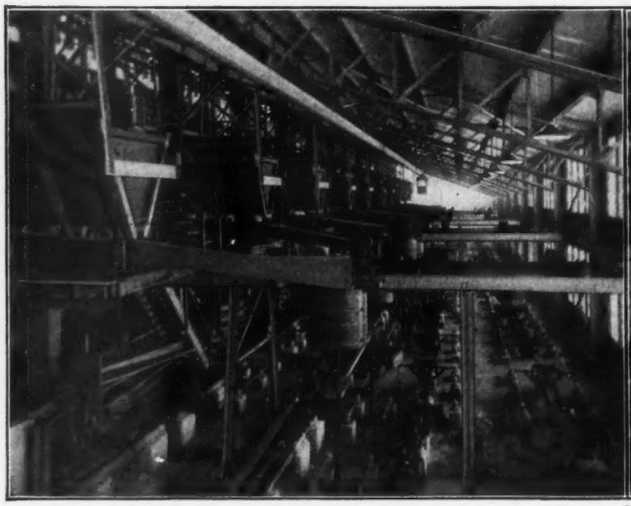


One of the car tipples at top of mill

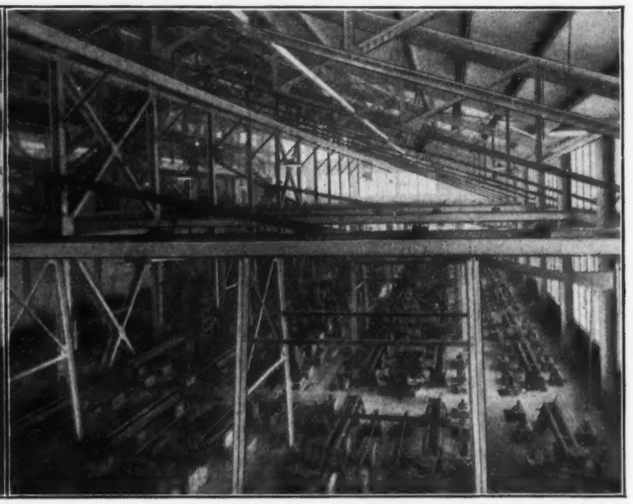


Ball-mill floor—looking east

Tube-mill floor—taken Feb. 5, 1917



Roughing-table floor—looking east



Finishing-table floor—taken Feb. 5, 1917

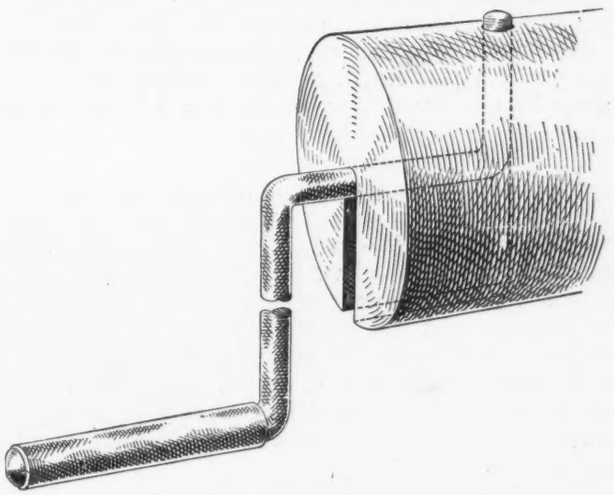
LATE VIEWS IN ALASKA JUNEAU'S MILL, WHICH WILL START IN APRIL

Details of Practical Mining

A Secure Windlass Barrel

By A. W. Allen*

A secure type of windlass barrel for prospecting or winzing is illustrated herewith. The handles are bent in the shape shown, and the barrel is bored across its full



A SECURE HANDLE FOR WINDLASS

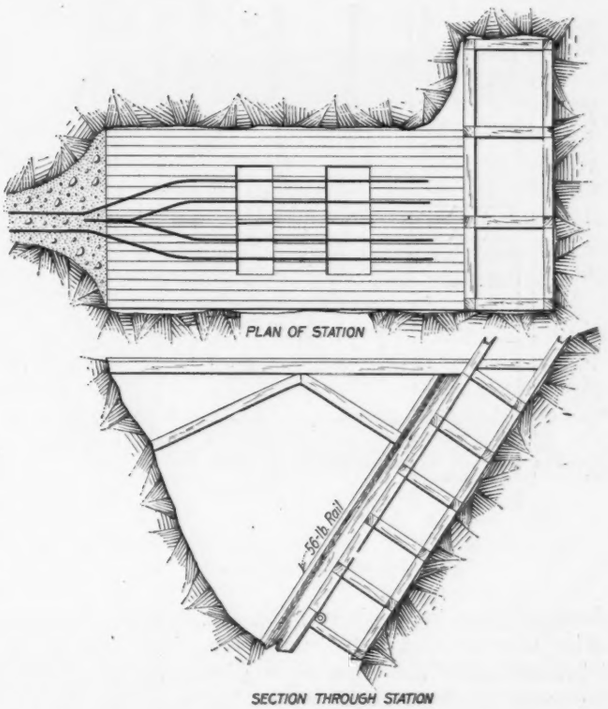
diameter at a point 8 in. or so from each end. A narrow radius space is then cut out to allow the handle to be inserted, and the opening wedged up.

Skip-Pocket Construction

By James E. Harding†

The following method of construction of skip pockets was used at the Dairy Farm mine, Vantrent, Calif. The ground around the station was good, and no timber was necessary for the support of the roof. In building a station in an incline shaft, the first work is to enlarge the shaft below the station to such size that the bottom and front timbers of the skip pocket may be put in place. In this instance the bottom three 10x10-in. timbers were placed side by side and perpendicular to the dip of the shaft and wedged solidly between the shaft timbers and the hanging wall of the incline. Then the front of the pocket was placed directly on the shaft timbers. First 10x10-in. timbers were laid directly on the cap ties and then up and down in each compartment between the ties. The distance between these latter was the same as the width of the pocket gate which delivered into the skip. Upon these 10x10-in. timbers a double layer of 2x12-in. plank was laid and last of all sections of 56-lb. rail were fastened with U-bolts to the plank as a protection. These ran up and down the shaft and were placed directly under the dumping holes to receive the shock of the falling rock.

When the front and bottom were in place, work started at the bottom of the pocket with machines and raised up and alongside of the shaft so that the back of the pocket formed an angle of about 60° with the shaft timbers. A flatter angle than this would have been useless because the chute would fill up with fine rock. The illustration of the skip pocket shows the angle of the front and back. When all the ground was taken out, the top of the station was put in place. A bed of four stringers of 10x10-in. timber, the length of the station, was laid, and the stringers were trussed as shown, and the division between pockets put in. On the top stringers sections of 56-lb. rail were placed crosswise, let into the stringers sufficiently to allow 2 in. of the ball and web of the rail to appear above the surface of the stringers. The rail sections were laid 12 in. apart to allow a 2x12-in. plank to be placed in the spaces between each two rails,



SKIP POCKET AT DAIRY FARM MINE, CALIFORNIA

spaces being left open for the dumping holes. Thus rails and plank left a smooth surface upon which was laid the second floor of plank at right angles to the first, still leaving the dumping holes open. Car track was laid over the dumping holes, forming a grizzly with the 56-lb. rails, with openings 12x18 in. A movable switch was placed leading from the single track of the crosscut to the double track at the station and a man kept at the station to tend the switch, assist in dumping cars and break rocks too large to pass the grizzly.

The construction of the station required 168 man-shifts besides supervision, about 300 lin.ft. of 10x10-in.

*Metallurgical engineer, 309 Broadway, New York.
†American Smelting and Refining Co., Caldera, Atacama, Chile.

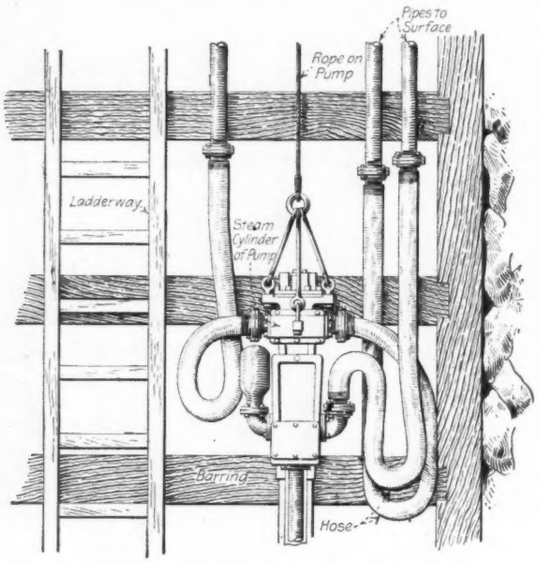
timber, about 1800 lin.ft. of 2x12-in. plank, and about 250 ft. of 56-lb. rail besides the dynamite used to break the ground. Single gates of ½-in. steel with the usual rack and pinion were placed in each pocket to empty directly into the skips which rest on chains across the shaft while loading, thereby saving the jar on the hoisting cable caused by the rock running into the skip. Two men loaded the skip, and fast work was possible if the rock was not too coarse.

Hose Connections on Sinking Pumps

By J. F. Kellock Brown*

The flexibility attained through using hose connections in handling sinking pumps in shaft work may not be an original idea, but it certainly deserves to be more widely known and applied.

As the sinking of a shaft proceeds and the depth increases, the sinking pump has to be frequently lowered. Usually this is done by fitting in short lengths of pipe, until a sufficient distance for a full pipe length has been sunk. This may be a comparatively simple matter where there is little water in the shaft and there is consequently



ARRANGEMENT OF FLEXIBLE HOSE CONNECTIONS FOR SINKING PUMPS

plenty of time in which to make the change. Remembering however, that a shaft pump must have attached to it two and sometimes three pipes (depending on whether the power is steam or air)—the intake steam, the exhaust steam and the water discharge. These pipes extend to the surface, and in a long distance it is a hard task to juggle the pump up and down so that they may be changed and brought into position to be properly connected to the pump. Three full lengths have to be changed at one time, since the alternative of working with a number of short lengths of varying measurement implies too much "dodging" for position. It is nearly impossible to get three pipe lengths projecting down a shaft to remain in the same straight line, so that they can be readily attached to the pump. Nearly always the pump piece, probably a short nipple, and the pipe to which it is to be attached meet at an angle sufficiently large to make the threading of the one piece to the other a matter of great difficulty. This is greater in inclined shafts, where the pipes lie along one wall and where a projecting piece of timber may throw them out of line. In large sinking operations these difficulties are provided against, but in small prospecting work there is much thoughtless procedure. In cases where there is excessive water and the pump is working to its utmost capacity, the time spent doing this pipe changing is often so great that no progress can be made. During the time of change the water has risen so rapidly that the pump should have been left where it was before the proposed change was made.

To overcome a series of difficulties of this character in one particular instance, the scheme was tried of inserting in the pipe line between the bottom lengths of pipe and the pump, a pipe length of hose. Twenty-two feet of steam hose for the steam pipe, the same for the exhaust pipe, and also for the discharge pipe, were cut and fitted with a short nipple connection and a union. The connections between the hose, pump and pipe were made by means of unions, one at each end of each hose. As there was pressure on steam- and water-discharge connections, care had to be taken to have them fitted extra tight, since a sudden blowoff of steam or a burst of water through a broken connection is an unnecessary evil. The kinking of the hose had to be watched, and when the pump was close to the pipe ends, the coils of hose were looped by leather holders and marlin tying strings to nails driven in the timbers so placed that the hose would be clear of the working space in the shaft.

The advantages gained by this scheme were flexibility of the pumping arrangements and speed in changing pipe connections. The disadvantages of any twists in the pipe from the surface to the pump were readily obviated by the use of the hose; the pump could be lowered 20 ft. at a time without changing the pipes and could be kept working if required during the lowering process. This prevented the loss of time during which the men working in the shaft bottom were driven out by water and the time while that water was being pumped out. The hose and the unions facilitated the changing of the pipes to a great extent. The three pipes to be changed were lowered by rope to the pump and hung in position along the side of the shaft, while the pump remained where it was without any change. The pumpman took his position with his pipe wrenches, at the top connection of the hose and pipe, where he broke the unions of all three connections in turn. His assistant stood on the pump below. The bottom end of each pipe to be changed into the new position, lying ready at the pumpman's hand, had on it the upper half of a fresh union, and to this the pumpman lightly attached the hose. The pump and hose were then lowered to the second man, who detached the hose for the time being while the man above connected his pipe to the line, and the man on the pump tightened up his union between hose and pump and the connection was ready for operation. A similar procedure took place with the remaining two connections. This meant only a short time lost at the change and reduced the danger of a lost pump.

*Mining engineer, with Arthur D. Little, Inc., 137 McGill St., Montreal, Canada.

Folding Blueprints so the title may be read and so that the blue surface is not exposed to the light and to wear is accomplished at the Copper Queen by the simple expedient of folding the printed side in and finally turning over diagonally the last corner containing the title.

Correspondence and Discussion

Flivver Merchantmen to Overcome Submarine Menace

The German submarine is a factor with which the United States must contend, whether we go into the war or keep out of it, if we intend to maintain our established commercial rights. The only sure method of neutralizing the effect of the U-boat campaign is to create tonnage as fast or faster than it can be destroyed. If this country could build ships of a type capable of evading the U-boat and build them faster than Germany could sink them, it is probable that Germany would be prepared to retract from the indefensible position she has taken.

The rate at which steel ships are being built cannot be increased, as our shipyards and rolling mills are doing their utmost now. It is possible, however, to build a large number of small wooden cargo boats of from 1000 to 2000 tons' capacity, equipped with internal-combustion engines. Boats of this type have been built for the last few years on the Pacific Coast and have demonstrated their usefulness as cheap and efficient cargo carriers. These boats, as built on the Pacific Coast, are equipped with semi-Diesel motors and have a sea speed of about nine knots. The most efficient size, from a purely commercial point of view, is between 3000 and 4000 tons' capacity; but if boats were to be built for the purpose of carrying cargoes through submarine-infested waters, it is probable that it would be advisable to sacrifice commercial efficiency and economy in operation in order to get both sufficient speed and quick-turning ability to give the best possible chance to evade the submarines. With this in view it seems probable that a boat of between 1000 and 2000 tons' capacity with a speed of 14 knots would be advisable. It is possible that, to secure a speed of 14 knots, it would be necessary to make a further sacrifice of economy and use a gasoline engine instead of a Diesel or semi-Diesel type.

Low Visibility a Large Factor

A fleet of a thousand such ships equipped with bow and stern guns would have a great many advantages and a maximum chance of getting their cargoes safely to port. Such ships would have very low visibility and would be seen at about one-third the distance of the steamship, thus multiplying the number of submarines necessary to establish a tight blockade. They would be small and specially designed for quick turning. For these reasons the number of misses made by the U-boats would be greatly increased. Furthermore, such boats operate with very small crews, from 12 to 14 men; the value of the cargo on any one ship is small, so that when one of them is sunk the loss in personnel, cargo and shipping is small. For offensive purposes 10 small ships each armed with two guns are much more effective than one large ship with two guns. In case we should become involved in the war, a fleet of such ships would be immensely valuable for patrol boats, mine laying and other purposes.

To build these boats, it would be necessary to utilize the facilities of every wooden shipyard in the country. It is probable that a considerable number could be made in the old yards up and down the Atlantic Coast, but the two points at which the greatest number could be built would be the Pacific Coast, with its inexhaustible supply of lumber and enormous mills, and the upper coast of Texas, where similar conditions prevail. To build a wooden ship does not require the yard and equipment necessary for the construction of steel boats. About all that is necessary is a crane for handling heavy material and a small amount of woodworking machinery. Such boats should be absolutely standardized, the timbers sent from the mill ready to be bolted into place, and in the construction utmost skill in scientific management could be utilized.

There is in this country the necessary lumber and the facilities for getting it out. We have the labor; we can build the engines. It is physically possible for this country to turn out ships of this kind at a rate absolutely to neutralize the U-boat campaign. If this were done, it would probably end the war very quickly. With these two points established, any ordinary argument of difficulty or cost has very little weight.

The war is at present costing not far from $200,000,000 per day. One-half of the daily cost, or $100,000,000, would put 1,000,000 tons of wooden shipping in the water and do more to bring about the end of the war than any other possible action on our part.

This plan has had careful consideration by leading shipping men in this country, as well as some of our foremost naval authorities, and has been strongly indorsed by them as being the most effective move this country could make to end the war.

F. Huntington Clark,
Mining Engineer.
465 West End Ave., New York City, Mar. 10, 1917.

Refinement in Chemical Analysis

The first step for obtaining real "Refinement in Chemical Analysis" (discussed editorially in the *Journal,* Mar. 3, 1917) in commercial work is to ascertain the exact present condition. For many years I have had the question of improving the accuracy of gold-bullion assaying under investigation, during which time probably 100,000 special assays have been made on thousands of samples, which have been supplemented by voluminous records of regular work.

The most troublesome point in such an investigation is the question of personality—the personal equation, if you will. We are all subject to many untoward influences, to many of which we are entirely unconscious, but for some we have vague consciousness and it is difficult to draw the line. As a general rule, one of the most fatal obstacles to real accuracy in commercial work is knowledge by the

operator of previous results, and the condition is worse when he has an interest of any kind in the result. Even such an intangible interest as loyalty to his superior may influence a weigher. Therefore, when the best results are desired, the operator must not be able to tell at a glance what the answer is going to be when making the final observation, weighing, volume reading, etc. He should then simply record the facts. The calculations to show the final results should be made independently. It is far better to have someone else make the calculations, although this is not always possible, but at least the operator should not undertake the calculations before finishing the observations. In a large laboratory the operative records should be delivered to an independent calculator to work out the results.

While it is apparently a great time saver in a busy laboratory to have the final observation be the figure sought, yet this practice leads to and covers up much poor work. In gold-bullion assaying, the cornet weight is generally the fineness of the bullion. The influence of this upon the accuracy of the work is well illustrated by the fallacy of agreeing duplicates. Four samples representing a melt of fine gold were each assayed in duplicate, and every one of the eight results was 999.5. The samples were returned to the laboratory without any knowledge as to what they were. Now 10 out of 12 duplicates agreed, but the sets of duplicates varied from one at 999.1 to one at 999.6, and only one was at 999.5. Institutional pride was largely responsible for the first total agreement and for the agreement of duplicates in the test.

Again, 34 assays were made in four laboratories on the four samples representing a melt. Agreeing duplicates were reported at 999.4 and 999.8 and at each 0.1 between, while an individual assay was reported at 999.9. This variation may be taken as a fair illustration of the present actual accuracy of such work, when cutting the sample to a fixed weight. Undoubtedly more reliable results would be obtained by cutting the sample to between 500 and 501 mg. and weighing to 0.01 mg. with the rider, the cornet being weighed back in the same way. This would require a calculation to get the fineness, but on the whole would probably not consume any more time than in cutting to a fixed weight.

FREDERIC P. DEWEY,
Assayer, Bureau of the Mint.

Washington, D. C., Mar. 6, 1917.

Underground Boxes for Primers

I am a great believer in the safety-first movement and at all times encourage it in every reasonable way possible. However, it seems to me that the idea can be run into the ground by incapable inspectors. As a case in point let me offer an incident. We received a visit from a deputy inspector who complimented us on general underground conditions and also offered a few suggestions. At that time we had, on one of the levels, a good fuse-and-cap room, where various lengths of fuse were cut and capped as needed. Complying with a suggestion from the inspector, this was removed. On the surface a suitable room was arranged, and therein a stock of capped fuse in various lengths was kept on hand. It was then made a duty of the nippers to deliver to each miner, in time for loading, the exact number of primers he required.

About six months later another deputy inspector called on us. Practically everything underground met with his approval. However, developments indicated that in order to be making good he had to pick a flaw somewhere. At the time of his visit we were just completing the station, skip-pocket, etc., at a new level. Timbermen, pipemen and trackmen were engaged in putting the finishing touches to the job. The place was in more or less of a mess, littered up with scraps of lumber, pipes, track and tools. This was all carefully explained to the inspector and the information added that the next eight hours would see everything cleaned up and active work starting on the level. In prowling around he discovered an empty powder box in which lay a 2-ft. piece of fuse without a cap on either end. Undoubtedly it had been trimmed from a long primer used in blasting a plug in the station work. An inquiry was in order regarding our plan of handling primers. This was explained and the surface fuse room shown to him. About a week later we received a suggestion by mail that fuse boxes be constructed of 2x12-in. material and installed on each level.

One day a miner from one of the stopes came to the level for primers. A nipper not being in evidence at the moment, he looked in the fuse box and found enough for his needs. He returned to the stope where he and his partner loaded the round of eighteen holes. Now, without his knowing it, some of the fuse had been in the box for a long time, and though the box was well made, it must have absorbed more or less moisture. Some of the fuse could not be lighted. After trying in vain to spit these fuses, both men took out their knives, cut off several inches of the length, split the fuse in fresh places and tried again, with no better success. All this time some of the fuse was burning merrily on. They kept this up as long as they dared and then ran for the manway. One man had cut his hand, and both had been burned slightly. When the men were about 10 ft. from the bottom of the manway, the first shot went off and a stray rock weighing about 5 lb. came flying by them, fortunately missing both. When the next shift went up into this stope, they found eight missed holes and the round ruined.

New York City, Feb. 15, 1917. S. FORD EATON.

Exploration in Sudbury Nickel District

An article in the *Engineering and Mining Journal*, of Jan. 6, 1917, by Thomas W. Gibson, Deputy Minister of Mines of Ontario, makes note of the fact that "diamond drilling during the year (1916) disclosed the existence of important orebodies on the norite contact east of the Garson mine, where the glacial drift is 100 ft. thick and there is no outcrop to be seen."

The E. J. Longyear Co., which did this work, is still drilling in this vicinity and has recently sunk a test shaft on the property for the purpose of checking the results of the drilling. This exploration is interesting for the reason that there were no surface indications, and the work must have been guided largely by considerations of the general geology of the district. Work of this type is frequently carried on in the iron and copper districts of the Lake Superior region, but has not hitherto been attempted to any great extent in the drift-covered regions of Ontario. Thus it would appear that the recent discussions on the origin of the Sudbury ores in the *Journal* have more than an academic interest. These problems have a vital relation to the development of new orebodies.

Sudbury, Ont., Feb. 20, 1917. JAMES W. MARTIN.

The Annual Meeting of the Canadian Mining Institute

MONTREAL CORRESPONDENCE

SYNOPSIS—The yearly meeting of the Canadian Mining Institute brought forth a large number of interesting technical papers, many of them based directly or indirectly on the problems growing out of war conditions. E. P. Mathewson, formerly of the Anaconda Copper Mining Co., but now with the British America Nickel Corporation with headquarters at Toronto, read some interesting papers, and received the gold medal of the Mining and Metallurgical Society of America, for his contributions to the art of metallurgy.

The nineteenth annual convention of the Canadian Mining Institute was held at the Ritz-Carlton Hotel, Montreal, Mar. 7 to 9, 1917. The proceedings were of unusual interest by reason of the many problems which have arisen on account of the war and the recent expansion of the mining and metallurgical industries. President Arthur A. Cole in his annual address said that the abnormally high prices of metal had stimulated the mining industry and 1916 had established a new mining record. It had been a year of activity for the Institute. It was through its influence that a guarantee had been obtained of ample supplies of cyanide for the Canadian mines at lower prices than prevailed elsewhere. A metallurgical section had been formed, which had already extended the scope of the Institute. In the past a lack of coördination had been a notable defect in administration methods. Enormous masses of information had accumulated in the government departments, universities, and company and private offices, but a strong central organization was necessary. The recommendations of the Institute a year ago for the appointment of a commission to organize the departments of the civil service for the purpose of correlating information respecting the resources of trade and industry had resulted in the creation of such a commission. Last year was the most active and successful in the history of the Institute. The preliminary report of John McLeish, chief of the Division of Mineral Resources and Statistics, on the mineral production of Canada during 1916 was presented.

The preliminary report of Thomas W. Gibson, Deputy Minister of Mines for Ontario, on the mineral production of Ontario for 1916 was presented.

INDUSTRIAL PREPAREDNESS

E. P. Mathewson read a paper on "Organization for Industrial Preparedness," taking the ground that Canadian statistics were based on insufficient data. The Institute should recommend the government to appoint a special statistical board from the officials of the Bureau of Mines, Geological Survey, Labor Department, Internal Revenue Department and Census Bureau to compile the necessary data concerning industries, publish yearly reports and give statistics indicating possible openings for new industries.

Dr. Frank D. Adams read a paper somewhat along the same lines on the work of the Advisory Council for Scientific and Industrial Research. An interesting discussion ensued in the course of which Mr. Mathewson urged that the first and most obvious duty of the Research Commission was to call attention to the need for the electrification of railways where coal was not easily available. James Whyte, chief of the Conservation Commission, said it was questionable whether the roads could afford the initial cost. Moreover, it would be difficult to increase the amount of Niagara power under the arrangement with the United States, but he looked forward to a time when railroads within a reasonable distance of the great water powers would be electrified. Mr. Cole said that the electrification of the Temiskaming & Northern Ontario Ry. was now under consideration. Dr. Adams stated that the available water powers had all been mapped out and that the matter of electrifying the principal railways was receiving attention.

A paper by Gordon Spencer on the possibilities for the manufacture of cyanide in Canada was read, which treated of the methods in vogue in Germany. Alfred W. G. Wilson, of the Mines Department, Ottawa, favored the cyanamide process as being most applicable in Canada. President Cole detailed the steps taken by the Institute to relieve the situation caused by cyanide shortage for the Northern Ontario mines and stated that negotiations were now on foot with the Cassel Cyanide Co., for the starting of a Canadian branch of the company.

CANADIAN METALLURGICAL POSSIBILITIES

"Electrochemical and Metallurgical Possibilities in Canada" was the subject of a paper by H. E. Howe, who contended that in order to make these industries successful it would be necessary to bring about a lower price for power, and insure consumers large blocks of power which must be steady and continuous, and also cheap freights and abundance of raw material. In the discussion following the paper Dr. Goodwin, of Queens College, Kingston, suggested storage of water to prevent a failure in the power supply and W. D. Dick said that Canada was transmitting power to the United States to the detriment of her own industries.

On motion of D. B. Dowling, a resolution was unanimously adopted sending the greetings of the Institute to their members at the front, overseas.

H. J. Roast read a paper on the "Development of Canadian Magnesite," illustrated with lantern slides showing the magnesite formations. The same subject was dealt with by H. J. Ross in a paper on "Magnesite and its Uses," samples being exhibited showing its variations in appearance and brick and other articles manufactured from it. Mr. Ross strongly urged that the crude material should be manufactured in Canada.

C. W. Drysdale, of the Geological Survey, stated that large deposits of magnesite of a good grade occurred in British Columbia. Mr. Ross stated that to establish the industry would require a large amount of capital, probably about $250,000. In treating of "Potash and its Uses," C. W. Drury expressed strong doubts as to the successful use of feldspar in potash manufacture.

H. H. Claudet dealt with the "Concentration and Marketing of Canadian Molybdenite," and gave some interesting details as to the growth of this new Canadian industry, with illustrations of the leading molybdenite properties. J. B. Tyrrell gave an account of the molybdenite occurrences in British Columbia. J. S. Coffin pointed out the advantages of pulverized fuel for locomotives.

At the evening session Dr. Henry M. Payne told of hot water thawing in the Yukon.

Edgar Rickard told of the work of the Belgian Relief Commission, organized by Herbert C. Hoover, in saving millions of the Belgian people from starvation. By a unanimous vote of the convention Mr. Hoover was made an honorary member of the Institute. An interesting feature of the session was the showing by H. W. DuBois of a number of motion pictures vividly illustrative of scenes in Alaska.

On the second day metallurgical subjects held the foremost place in the topics discussed, which were of a most interesting and timely character. The chair was occupied by Dr. Porter, of McGill University. E. P. Mathewson led off with a paper on the "Electro-Deposition of Zinc from Aqueous Solutions," which he said was no new thing, though it was decidedly novel to produce zinc in this way in successful competition with established furnace methods. The Siemens & Halske experts were early in the field, and the names of Hoepfner, Engelhardt, Huth and Isherwood were prominent. The Japanese, Australians and Tasmanians were producing electrolytic zinc. The complex ore question had been practically solved, and former waste had become valuable. The extremely costly experiments of the Anaconda Copper Mining Co. had resulted in the establishment, at Great Falls, Mont., of a plant which was the largest and best-equipped refinery in the world and which was in December producing 95 tons of zinc daily, of a purity of 99.92%. He described the process in use by the company. E. E. Watts dealt with electrolytic zinc in eastern Canada and spoke of the experimental work conducted at the McGill University, which had proved it to be possible to manufacture electrolytic zinc in Canada on a commercial scale. There were two operating zinc mines in Quebec—that of the Zinc Mining Co.—with a daily output of 120 tons, and the Tetreau mine, producing 100 tons per day. An interesting discussion ensued on the respective processes at the Anaconda and Trail, B. C., smelteries, one of the points brought out being that while the Anaconda company raised no objections to iron content in the ore, a difficulty had been experienced at Trail in the roasting of ore that contained iron. Mr. Mathewson, in replying to some of the speakers, said that in normal times electrolytic zinc would be able to compete successfully with retort zinc owing to the value of other metal products recovered.

Iron and Steel Industry

"The Future of the Iron and Steel Industry in Canada" was the subject of two papers which, in the absence of the writers, were read by the chairman, the question being considered from the standpoint of preparedness for new conditions after the war. That by D. H. McDougall emphasized the temporary character of the present prosperity due to the artificial stimulus of war conditions. The factors of permanent success included ready access to raw material and coal and the proximity of markets for the output. While large concerns favorably situated in these respects would survive, new conditions would probably eliminate many small businesses at present profitable.

F. Whilton made an elaborate presentation of the position of the iron and steel plants, with a description of the equipment of the Dominion and Nova Scotia steel works, which he said were the most favorably situated in Canada. He gave voluminous statistics of production in the various lines and figures showing that the manufacturers of the United States had an immense advantage in the lower cost of production. F. P. Jones took strong exception to the figures as to the respective cost of production in Canada and the United States as being incorrect. He thought what was needed to protect the industry was a more uniform tariff. G. A. Irving, of the Algoma Steel Co., thought that manufacturers should have a more diversified output. His company was installing a mill to produce structural shapes, and other companies were contemplating the manufacture of new lines. There was opportunity for expansion by all the plants.

J. A. Dresser said that the lack of suitable raw material should induce further prospecting and exploration in search of new mineral deposits. S. F. Belknap, Deseronto, urged government action to further the supply of raw material. Dr. Porter thought that the Canadian iron ore would have progressed much more rapidly but for the high-grade character of the ore procured from the United States. R. R. Hedley, of Vancouver, contributed a paper on the iron industry of British Columbia, claiming that the province had all the factors necessary for its successful development. "The Occurrence and Testing of Moulding Sands" was the subject of a paper by L. H. Cole.

Raw Materials for Manufacture of Refractories

At the afternoon session N. B. Davis dealt with refractory clays. It was only lately, he said, that manufacturers had begun to use raw material for the making of refractory goods. He showed the widespread distribution of clays and shales which constituted raw material for the making of silica, magnesite and chromite brick. He mentioned that quartzite pebbles suitable for tube milling occurred in Saskatchewan. S. V. Ells, with the aid of illustrations, described the bituminous sands of northern Alberta, the largest deposits in the world and wholly undeveloped. They covered an area of 1800 square miles. The lack of transportation was a serious handicap, but one that would shortly be removed. The quality of the material had been proved by its use for the construction of pavement in Edmonton, which was in a satisfactory condition.

Robert E. Dye told of milling practice at the Buffalo Mines, Cobalt, where a Callow flotation plant of a capacity of 500 tons per day had been installed. Its satisfactory operation was proved by the fact that while the cost of the cyanide process was $2.04 per ton, flotation had reduced it to $1.99. It was necessary, however, to develop the local method for the treatment of concentrates. A paper by John M. Callow and E. B. Thornhill, on "Flotation by the Callow Process in the Cobalt District," was presented, showing the economy of the process. The present problem is the reduction of flotation concentrates to reduce the cost of freight. It was contended that as the Cobalt ores decreased in grade, flotation would become more important to enable the mining of low-grade ores at a profit. C. S. Parsons, in his paper on "Flotation Experiments with Canadian Wood Oils," gave the results of a series of tests made at the Forest Products Laboratory

of McGill University in the production of wood oil for mining purposes, including experiments at utilizing pine stumps for that purpose.

"The Chromite Deposits of Quebec," was the subject of an address by Dr. Robert Harvie, who said that they occurred in masses which sometimes contained as high as 2000 tons, as well as in the form of disseminated ore. The latter he thought would be the principal source of supply for the future.

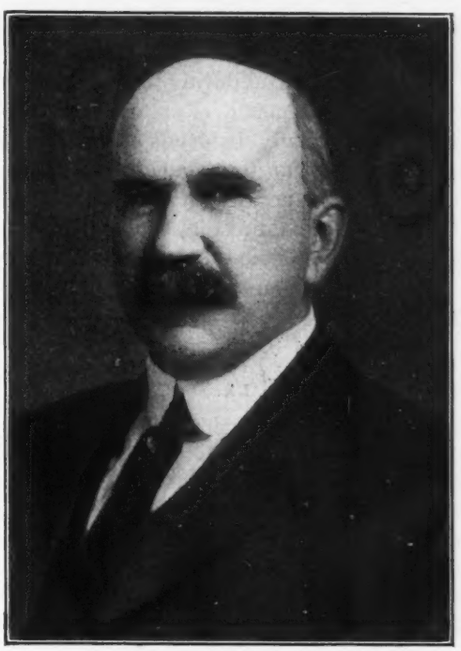
Officers for the ensuing year were elected as follows, the president and most of the last year's council being reelected by acclamation: President, Arthur A. Cole, Cobalt; vice-presidents, D. B. Dowling, Ottawa, and M. E. Purcell, Rossland, B. C. Councillors: For Nova Scotia, F. H. Sexton, Halifax. For Quebec, L. D. Adams, Montreal; T. C. Denis, Quebec; A. Stansfield, Montreal. For Ontario, M. B. Baker, Kingston; W. J. Dick, Ottawa; Norman R. Fisher, Cobalt; Reginald E. Hore, Toronto; G. C. Mackenzie, Ottawa; E. P. Mathewson, Toronto; W. E. Segsworth, Toronto; Clifford E. Smith, Toronto; J. H. Stovel, Sudbury; M. W. Summerhayes, Timmins. For British Columbia, E. E. Campbell, Anyox; Thomas Graham, Victoria; G. P. Jones, Hedley. For Alberta, W. A. Davidson, Calgary; Walter F. McNeil, Calgary; Norman C. Pitcher, Edmonton.

The annual banquet was held in the evening at the Ritz-Carlton Hotel and was of more than usual interest, as it was made the occasion of the presentation to Edward P. Mathewson of a gold medal for distinguished services, from the Mining and Metallurgical Society of America. A delegation from the society was in attendance. W. R. Ingalls, in making the presentation, recounted the important contributions to mining and metallurgical science made by Mr. Mathewson during his career of 32 years, in recognition of which he had received the gold medal of the Institute of Mining and Metallurgy of Great Britain. Mr. Mathewson, in a happy speech, expressed his appreciation of the honor conferred upon him and gave some interesting details of his experiences. P. N. Moore, president of the American Institute of Mining Engineers, conveyed the greetings of the Institute and congratulations on the success of the convention. President Cole, in the course of a few well-chosen remarks, alluded to the part taken by the members in the war, 25% of the membership being at the front. Other speakers were: J. W. Flavelle, head of the Imperial Munitions Board; Hon. Honore Mercier, Minister of Colonization, Mines and Fisheries for Quebec; Edgar Rickard, of the British Institute of Mining and Metallurgy; and Lieut.-Col. Caldwell.

A party of the members of the Institute accepted the invitation to visit various munition plants and see the operation of the industry under stress of war demands.

Edward Payson Mathewson

Edward Payson Mathewson was born in Montreal, Canada, Oct. 16, 1864. He received the degree of B. S. from McGill University in 1885. From 1886 to 1897 he was assayer and later superintendent of the Pueblo Smelting and Refining Co. Here Mr. Mathewson showed a spirit of investigation and research which resulted in many improvements in lead smelting. From 1897 to 1902 he was a member of the Guggenheim technical staff. He was at first superintendent and later general manager at Perth Amboy, N. J., where he improved greatly the lead-smelting practice. Later he was sent to Monterey, Mexico, and to Antofagasta, Chile. From 1902 to 1916 he was connected with the Anaconda Copper Mining Co., first as superintendent of blast furnaces and later as manager of the entire plant. Here he made many improvements in copper smelting, increasing greatly the the size of the blast and reverberatory furnaces, thereby reducing costs and fuel consumption and increasing their efficiency. In 1905-06 he conducted important and far-reaching investigations into the damage by smeltery fumes and their effect on vegetation and animals. In 1911-12 he directed and supervised the work of his assistant, Frederick Laist, on the lixiviation of copper tailings and precipitation of copper by sponge iron produced by direct reduction of iron ore. In 1913-14 he directed the investigation of Mr. Laist for the leaching and electrolytic precipitation of zinc ores. He has been also a constructor and manager of large smelting plants; for example the plants of the International Smelting and Refining Co., at Tooele, Utah, and its lead refinery at East Chicago.



EDWARD PAYSON MATHEWSON
Recipient of the 1917 gold medal of the Mining and Metallurgical Society of America

Mr. Mathewson has contributed important papers to the *Transactions* of the American Institute of Mining Engineers. In 1907 (Vol. 38, p. 184) on the "Relative Elimination of Iron, Sulphur and Arsenic in Bessemerizing Copper Matte"; in 1912 (Vol. 44, p. 781) on the "Developmnt of the Reverberatory Furnace for Smelting Copper Ores"; and in 1913 (Vol. 46, p. 966) on the "Development of the Basic-Lined Converter for Copper Mattes." His investigations on the effects of smeltery fumes were published in pamphlet form. In 1911 he received the gold medal of the Institute of Mining and Metallurgy of Great Britain.

In 1916 Mr. Mathewson resigned from the Anaconda company to become connected with the British America Nickel Corporation, Ltd., with headquarters in Toronto. For his distinguished services he was awarded the 1917 gold medal of the Mining and Metallurgical Society of America.

American Smelting and Refining Co.

The eighteenth annual report of the American Smelting and Refining Co., to the stockholders, for the year ended Dec. 31, 1916, states that the earnings of the company and its subsidiaries, for the year, after deducting general expenses, fixed charges and corporate taxes, aggregated $25,242,297. This was an increase over the results of the preceding year of $8,999,877 and an increase over the year 1914 of $14,430,382. From the earnings as given, there was deducted the annual charge for depreciation and depletion of ore reserves, $1,990,048; appropriation for employees' bonuses, $575,000; appropriation for pension fund, $275,000; appropriation for welfare work, $150,000; miscellaneous profit and loss charges, $100,000; a total of $3,090,048; leaving total earnings applicable to dividends of $22,152,249. Preferred-stock dividends for the year amounted to $5,993,258, leaving applicable to dividends on the common stock, $16,158,991. This is in excess of 32% on the amount of common stock upon which dividends were paid during the year, or nearly 30% on the amount of common stock outstanding Dec. 31, 1916. Regular quarterly dividends at the rate of 6% per annum were declared on the common stock, amounting to $3,140,576. The balance carried to profit and loss account was $13,018,415. The directors believed it wise to make special appropriations from surplus account as follows: To credit of property account and miscellaneous items, $3,136,559, and for reserve for enlargement and extension, $6,000,000; a total of $9,136,559.

Total Gross Earnings for the Year

A comparison of the accounts with the semiannual report made as of June 30, 1916, shows gross earnings for the first half of the year, $13,229,059, and for the last half, $14,888,773. On the other hand, the net earnings reported for the first half of the year were $11,145,694, and for the last half, $11,006,556.

From the gross income for the last half of the year were deducted the increased income tax on the earnings of the entire year and the special appropriations for employees' bonuses, pension fund and welfare work.

The high prices for metals recorded in the last semiannual report, which were therein mentioned as being the cause of a largely increased production of ore and bullion for smelting and refining, continued, with few exceptions, and exceeded the prices of the earlier part of the year. The smelting and refining operations of the company correspondingly increased. Wages and the cost of fuel and material have continued to advance. The scarcity of all materials needed for construction and operation, together with unequaled congestion on the railroads of the country, united to make the continued working of the smelting and refining plants most difficult. However, at the close of the year the tonnage being handled and the refined metals produced were never equaled in the life of the company.

While constantly increasing costs made some lines of operation comparatively unprofitable, there were compensating advantages which were more than an offset. The policy of the company continued to favor enlargement and extension of its operations and a diversified production. By these means a proper expenditure of the present abnormally high earnings, it is believed, will insure a continuation of earnings which could not otherwise be expected.

While none of the Mexican smelting plants of the company were operated during the year 1916, a few of the mines were worked, entirely under Mexican supervision. At the time of the writing of the report, steps were being taken to open up both the Monterey and Matehuala plants. Movement of materials in Mexico will largely be effected through the use of locomotives and cars belonging to the company. Favorable arrangements have been made with both the national and state governments, and it is evidently the earnest desire of the Mexican people, both in official and private life, that accustomed business shall be resumed. Until, however, the destructive effect of the past few years has been largely overcome, all business in Mexico must expect to be greatly hampered by high costs, especially in taxation and freight.

Property Purchased in Chile

The board of directors, after due examination and deliberation, extending over the last two years, decided to enter into the mining and smelting business in the Republic of Chile. The company purchased, during the year, the Caldera smeltery, together with a highly mineralized zone, including many mines which are but imperfectly developed. There was purchased, also, the stock of the Carrizal Smelting Co.

An important and favorably developed mining property in Mexico, adjoining and extending the mines of the company at Parral, was secured at a value which was believed warranted, even if operations may be delayed.

Smelting Operations

The tin plant did not produce to its full capacity until the latter part of the year. The production is now about 600 tons monthly, and the results are satisfactory, and an addition to the plant is therefore now under construction, which, it is hoped, will result in a production of 18,000 tons of pig tin per annum, after about July 1, 1917.

The increasing price at which electrolytic copper sold brought about, quite naturally, a constantly increasing production of ore and bullion for smelting and refining plants. This necessitated additions to all the copper smelting and refining plants, requiring the expenditure, during the year, of over $5,000,000, most of which was contemplated at the beginning of the year. In the last annual report it was stated that this construction would bring the smelting and refining capacity of the company up to 1,000,000,000 lb. of electrolytic copper yearly. With the completion of construction, now covered by appropriation, which should be in operation soon after the middle of 1917, the company will have a capacity for producing 1,300,000,000 lb. of electrolytic copper per annum.

Owing to the falling off in the lead ore coming to the company from the Cœur d'Alene mines, attention has been given to increasing the supply of lead from other sources. About $750,000 has been expended in enlarging the milling and smelting works and extending the development of mines of the company in Missouri. While the production, from this source, at the beginning of 1916, was approximately 42,000 tons of pig lead per annum, this was increased to 66,000 tons. Constant attention was given to increasing the supply of lead ore for the company.

During the year was completed the construction of a sulphuric-acid plant at Salt Lake City, with a capacity of over 50,000 tons per annum, and plans are being made to duplicate this plant as soon as a market can be found for the increased product. To this end appropriations have been made to cover experimental construction, looking to the production of various chemical products using sulphuric acid as a base. It is believed that these plants, when fully completed, will not only be large consumers of acid, but also commensurate producers of profit.

The saving of the major metals, heretofore lost through unscientific methods, and the production, as byproducts, of the minor metals and chemical substances were given increased attention by the metallurgical staff, and large expenditures are expected to be made during 1917.

In addition to more than $2,000,000 spent during the year in ordinary repairs and renewals, there was expended, as already outlined, and charged to property account, $8,285,226, covering the various enlargements and extensions, and for new property. There was credited to property accounted as appropriated, to cover expected extension and enlargement (1915), $3,900,000; for depreciation and ore depletion, $1,990,047; for special appropriation to credit property account, $2,563,010; for sale of various items of real estate, $109,483; a total of $8,562,540. This leaves the property account of the company, $141,165,684; having been reduced during the year $277,314.

Metal Stocks

The book value of ore, bullion and factory products on hand and in transit Dec. 31, 1916, less treatment charges accrued but not earned, was $105,254,065, as compared with the value of the same stock at the end of the preceding year of $58,582,143; an increase of $46,671,922. This increase was mostly in the weight of metal carried in the normal business of the company, as the average inventory price at which metals were carried was not increased during the year. Of this enormous increase, $42,813,134 was for account of mining companies.

The increase in inventory value of metals held at the risk of the company during the year was $3,858,788, which was only the normal increase made necessary by the total increase of material delivered to the smelting and refining works, together with the added carry, on account of delays in transit from smelteries to refineries, due to the congestion of traffic affecting the whole country.

The par value of bonds held by trustees in sinking fund, Dec. 31, 1916, was $4,110,000; par value held in the treasury of the company for which smelting company's common stock was issued in exchange was $4,191,000; leaving bonds outstanding, $6,699,000; a decrease for the year of $5,913,500. The Securities company called the entire outstanding issue of bonds for redemption, as of Feb. 1, 1917, and the exchanges which were made for common stock resulted in a total common stock issue, as of Feb. 1, 1917, of $60,998,000.

The Smelting company owns all the common stock of the American Smelters Securities Co. The bonds of the latter company have been redeemed. The 5% cumulative preferred stock, Series B, of the Securities company is guaranteed by the Smelting company, both as to interest and principal, and is therefore an obligation of the Smelting company, prior to its preferred stock.

After mature deliberation, the directors decided that it would be to the interest of the Smelting company to acquire the Series B preferred stock of the Securities company, by offering its first mortgage 5% bonds in exchange for the Series B 5% preferred stock of the Securities company, par for par.

At the end of the year, the cash on hand and in bank, subject to check, together with loans secured by Stock Exchange collateral, aggregated $19,941,492.

The total receipts from the sale of metals and manufactured products were $346,602,866, compared with the receipts from the same sources in 1915 of $219,603,470, and in 1914 of $183,146,077. Receipts from manufactured products increased from $4,103,228 in 1915 to $16,304,914 in 1916. While this unusual increase is largely due to rise in values, yet the volume and variety of products was no inconsiderable item, and a permanent advance in this direction is expected.

OPERATING STATISTICS

	1915	1916
Number of men employed, excluding Mexico	15,556	21,073
Total wages and salaries, excluding Mexico	$11,392,503	$17,047,944
Average wages per 8-hr. day	$2.44	$2.70
Tons charge smelted	4,153,092	4,789,474
Tons bullion refined	579,080	677,460
Tons coal used	604,204	724,595
Tons coke used	401,511	454,468
Barrels fuel oil used	829,304	1,107,285
Cubic feet gas used	1,071,593,000	2,130,460,328
Tons ore mined	1,578,611	1,638,566
Tons coal mined	235,222	224,807
Tons coke produced	120,660	140,961

METAL PRODUCTS

	1915	1916
Gold produced, oz	2,672,702	2,662,011
Silver produced, oz	76,117,453	71,868,451
Platinum and palladium produced, oz	693	868
Lead produced, tons	296,986	279,144
Copper produced, lb	551,798,000	789,438,000
Spelter produced, lb	36,154,000	47,807,547
Nickel produced, lb	1,120,556	1,224,328
Tin produced, lb	.....	3,262,000
Sulphuric acid produced, lb	34,124,000	25,842,000
Arsenic produced, lb	7,269,000	9,090,000
Copper sulphate produced, lb	8,366,000	13,046,000
Byproduct metals, lb	2,229,887	5,671,827
Copper and brass manufactured products, lb	8,763,480	31,597,489
Test lead and litharge sold, lb	355,229	417,898
Number loaded cartridges sold	12,898,000	15,338,000
Sheet lead, pipe, etc., sold, lb	9,638,205	21,713,331
Mixed metals sold, lb	2,566,255	2,831,617

Welfare and Safety Work

During the last year efforts in behalf of the welfare, health and safety of employees was vigorously continued. There was spent or appropriated, under this head, approximately $504,000, which was divided up as follows: $130,000 for building and improving company houses; $210,000 for what may be termed welfare, recreation and health; $85,000 for safety; $48,000 for pension, and $31,000 for life insurance. To which should be added the increase of $275,000 in the pension fund.

The company's efforts for the prevention of accidents during the year 1916 yielded satisfactory results, particularly in view of the fact that the number of men employed was increased 33%, which means that there was a very large number of green men who were not so well-versed in the dangers of the work, or the means of guarding against them, as the older employees. Based on the number of men per thousand, there was a reduction of 13% in fatal accidents, 34% in permanently injured and 9% in ordinary temporary accidents in 1916, as compared with 1915. At the same time the average number of days disability per temporary accident was reduced 1.01

The foregoing means that the actual results in 1916, as compared with the hypothetical results based on the 1915 record, show a saving of one life, nine permanent injuries and 200 temporary injuries, and this, in connection with the number of days disability, means that there was a saving in time lost because of injury of more than 6000 days.

Editorials

Belgian Kiddies

Mining engineers are not doing what they ought to in subscribing to the fund of Belgian Kiddies, Ltd. The sum to be raised is $120,000, and not yet has it been obtained. Remember that this is the special fund by which it is intended that mining engineers show their professional appreciation of Mr. Hoover and his work. The money that has been raised for this does not measure the liberality of the profession—if it did, we should be ashamed—for a good many have subscribed generously to the main fund of the C. R. B. We wish that in some cases they had put their contributions into Belgian Kiddies, which, of course, would have turned it over to the C. R. B. in the end, but the mining engineers would have had the credit for it.

However, we cannot but feel some mortification that the money for Belgian Kiddies, which was started three months ago, has been so slow in coming. There is not a mining engineer in this country who has not benefited from the high prices for iron, copper, zinc, lead, silver, tungsten and the whole list of commodities that are mined; and the high prices and the huge profits are directly attributable to the war, to the suffering of people in Europe. No one can with a clear conscience draw his big dividends, big bonuses or big increases in salary unless he gives some of it back to the people from whom it came.

The mining engineers of this country may be ashamed of themselves if they do not in short order supply the $30,000 to $40,000 that is needed to complete the Belgian Kiddies fund. Subscriptions should be sent the Belgian Kiddies, Ltd., care of Herbert C. Hoover, Equitable Building, New York. No sum is too small to be gratefully received, but there are many men in the profession who can afford to send checks for $100 to $1000 and ought to do so.

Weights and Measures

In the discussion of the metric system, which is now becoming active both in the United States and Great Britain, several things should be kept prominently in mind, especially the following:

1. The metric system already is legal in the United States. Anybody who finds it advantageous in his work and business may use it, and in fact does so if he wants to. The pro-metric party is aiming to make the metric system compulsory.

2. A distinction should be drawn between the metric system and the decimal system generically. The metric system is a decimal system and possesses the advantages that are inherent in such. But the English system may also be decimalized and is, in fact, used in that way when it is found advantageous. The surveyor uses a 100-ft. tape divided into feet and tenths of feet. The machinist uses the inch divided into thousandths. The architect measures roofing in squares of 100 feet. The water company sells its water in cubic feet, and tenths thereof. Probably the English system can be more extensively decimalized than it is, and will be. Let it be borne clearly in mind, however, that decimalization does not pertain solely to the metric system.

The pro-metric argument is advanced with a great deal of fallacy. We received recently an article from the New York Section of the American Chemical Society which may be taken as an example of this. We quote therefrom and add our comments:

"Prof. Kennelly, of Harvard, observed that whereas the metric system employs only two units of measurement, the meter and the gram, we have about 40 units and these are entangled in measures of length, area, volume, and in dry, liquid, cord, apothecaries', avoirdupois, troy, and what-not other standards until dire confusion has resulted."

The metric system itself has had to undergo a simplification in usage. There is no longer talk of the stere and the milliliter. Custom and convenience have substituted the cubic meter and the cubic centimeter. Similarly in the English system has there been simplification. Nobody now thinks or talks about the barleycorn, the palm, the coomb, the chaldron, or the pottle. There will be, without any doubt, much further simplification. Thus, the bushel may be supplanted by the cubic foot and fractions thereof.

There is a certain confusion in our weights, especially as between the pound avoirdupois and pound troy, and as between the long ton and the short ton, but the latter conflict, which is the more important, is disappearing with the gradual acceptance of the ton of 2000 lb. as the standard ton. But whatever confusion there be is not dire confusion and is far less dangerous than what exists in Germany with regard to the zentner and the doppelzentner, and in Chile with regard to the quintal and the metric quintal.

"Every nickel five-cent piece weighs five grams and is one centimeter in diameter."

It weighs five grams, but it is not one centimeter in diameter.

"A bushel is a measure of volume, but it is also a measure of weight, and while the volume is constant, the weights vary in the different states."

This is the first time that we ever heard that the bushel is a measure of weight. It is true that the several states have established by law what shall be the weight of a legal bushel of certain substances, and the figures vary, but that is a matter of measurement; not of the standard of measure, the latter being constant. It would be the same as if several states should prescribe that the cubic decimeter must comprise so many grams of rye, barley, buckwheat, etc., and the several states should vary in their prescriptions.

"The metric system is international and is employed in all Europe and America except Great Britain and her colonies, Russia and the United States."

This is a favorite and misleading manner of representing the use of the metric system, for it ignores the fact

that the United States and Great Britain and her colonies are the great industrial nations of the world, and together with Russia are the most populous. The correct way of making the statement would be to say that the largest nations of the world do not use the metric system, which is employed exclusively only in a portion of continental Europe and in Mexico and the countries of South America.

The need of the metric system in selling manufactured goods is another one of the fallacious arguments, for it disregards entirely the immense export trade that has been built up by the United States, and especially Great Britain, on the basis of the English system of weights and measures.

"It is held that any intelligent child can learn and carry in his head after three lessons, the whole metric system."

Considerable observation of children and attention to their instruction in the grammar school convinces us that this statement is not correct. We find on the contrary that children generally have difficulty in comprehending decimal fractions. Their natural tendency is to divide things into halves.

The circular recently issued by the New York Section of the American Chemical Society is erroneous in many respects, both in statements of facts and in arguments. The issuance of such a document does not comport with the dignity of so important a society.

Fords of the Sea

Great interest has been exhibited this week in a proposal by F. Huntington Clark, a mining engineer, for the construction of submarine evaders, which it is believed would prove successful in breaking a German submarine blockade.

The proposal, in brief, consists in the construction of a fleet of merchantmen built of wood, driven by internal combustion motors. Each ship would be 185 ft. long, have cargo capacity of 1000 tons, and speed of 14 knots. Lying low in the water, being without masts, and making no smoke, they would have no great trouble in evading submarines.

It is estimated that after six months such ships can be turned out at the rate of 1000 annually, which would make good the destruction by submarines. For the construction of such ships no elaborate yards are necessary. They may be built on ways by the harbor side, just as wooden ships were built in days of old. With standardized construction they can be built very rapidly. The greatest difficulty would be in providing the necessary number of Diesel, or similar, engines.

This project has received widespread endorsement in the highest quarters, including that of naval authorities, and has aroused the keen interest of the Federal Shipping Board. It is not unlikely that that board will enter upon such a building program. Mr. Clark's original suggestion was for the construction of 1000-ton ships, costing $100,000 each, but revised opinion appears to be in favor of ships of larger capacity, say of 2500 tons, costing about $200,000 each.

Mr. Clark's ideas undoubtedly have great merit. We are glad that they originated with a young mining engineer, formerly associated with J. Parke Channing. Great Britain is now building standardized steel ships of 8000 tons capacity. Standardization in shipbuilding is a wise step ahead. It will undoubtedly result in such economies as have been experienced in the construction of the Ford automobiles. In the popular mind, the new proposal for shipbuilding became immediately associated with Mr. Ford's manner of building automobiles, and the ships of Mr. Clark's fancy are already referred to as "Fords of the Sea" and "Flivvers," the latter being a thoroughly convenient term of reference.

The New Revenue Law

The new revenue law is in accordance with the present financial policy of making the very well-to-do and the corporations pay the additional taxes that are required. Discussion will center around the excess-profits tax. Profits in excess of 8% of invested capital, and a $5000 exemption, are to be taxed at the rate of 8%.

There is going to be some perplexity in determining the invested capital, especially in the case of mining companies. The main difficulty lies in the definition of "invested capital." Invested capital is supposed to include cash paid in and cash value of assets at the time they were transferred to the business.

The Alpha mine, producing 50,000,000 lb. of copper per annum at a profit of 5c. per lb., may be operated by a company that acquired the property as a prospect for $100,000, which, together with the plant and equipment, might represent all the capital actually invested.

The Omega mine, on the other hand, producing the same quantity of copper per annum at the same profit, was developed by an exploration company, which sold it to the present company for $5,000,000, which, together with the plant and equipment that had to be put in, represents the present capital investment.

The tax to be paid by these two mining companies will be widely different, or is there to be a physical valuation such as the Interstate Commerce Commission has been trying to figure up in estimating the capital value of the railways of the country? There is going to be a great muddle. Congress has left it to the Treasury Department to fix things by a series of arbitrary rulings, which then will have to be determined by the courts when they are sufficiently controversial and sufficiently important. We await with great curiosity the Treasury rulings respecting mining companies.

Canadian Mining Institute

The annual meeting of the Canadian Mining Institute at Montreal was an interesting occasion, as its meetings always are. However, the absence of so large a proportion of its membership at the front naturally detracted from the usual hilarity. On the contrary, there was a proper soberness about everything. The Mining and Metallurgical Society of America did a graceful thing by sending a delegation to Montreal to present the gold medal of the society to Edward P. Mathewson, who graduated from McGill 32 years ago and who thus received this honor in the city where he was born and educated. By the courtesy of the Canadian Mining Institute this presentation was made at its annual banquet.

BY THE WAY

A private compilation of copper lost on steamers sunk by submarines since the first of December places the total at 62,000,000 lb. Most of the copper so lost was bound to France, althongh Russia and Italy were also losers.

⁂

The directors of the Canadian Mining and Finance Co., Ltd., who are the principal shareholders in Hollinger Consolidated Gold Mines, Ltd., have made a substantial distribution of stock to the members of the staff of Hollinger Consolidated. They are further giving to each of the 75 or 80 employees who have enlisted with the British forces, 100 shares of Hollinger stock.

⁂

A recent "heat-neutralizing mixture for treating burns" is formed as follows, according to U. S. Pat. 1,204,830: A lard-like mass is formed of 13 lb. lime, 3.5 gal. water, 7.5 lb. black mineral oil, 2.5 lb. red oil, 2.5 lb. soda ash and 1 lb. yellow ochre. This sounds all right, but the description then adds, "The mixture may also be used as a lubricant on axle journals or other machine parts." As this concoction seems to be a sort of *vade mecum*, we nominate it also for salad dressing, hair oil and hog-cholera cure.

⁂

Speaking of professional ethics, the American Institute of Electrical Engineers has issued an elaborate year book for 1917, 6x9 in., 418 pages, bound in blue and gold, the frontispiece of which is a full-page illustration of the building of the United Engineering Societies, 27 to 33 West 39th St., which bears this caption: "Headquarters of American Institute of Electrical Engineers, 33 West 39th Street, New York, Executive Offices, 10th Floor; Library, 13th Floor; Auditorium, 3rd Floor." This is unworthy the dignity of a national engineering society the size of the Electrical Engineers and is hardly fair to the other founder societies that are interested in this building.

⁂

Orientals appear to be opportunists as well as fatalists. On the morning of Dec. 20, the 1-in. cable of the center compartment of the shaft at the Tabowie mines broke and the cage went to the bottom with 11 Koreans, who were killed. The next morning over 200 contract miners went on strike demanding an increase in prices. They established pickets in true Western style and prevented others from going to work. The company's manager reports from Unsan, under date of Jan. 4: "We managed to get between 20 and 40 men, including a few mill hands, underground to push cars and kept the mill going. This partly accounts for the big cleanup at Tabowie; we had to take ore that was already broken as the miners, who were not in sympathy with the strikers, were afraid to come to work. Thanks to the valuable assistance of the police, the strike came to an end on the 27th and by the evening of the 28th we had a full crew at work in their regular places and at the same rates."

⁂

The Colorado School of Mines *Magazine* publishes the following clever editorial under the caption, "It Pays To Advertise": "Write articles and send them to the *Magazine* for publication. Of course if you send them to the larger technical journals you may get from ten to fifty dollars apiece for them, but they will reach a wider circle if first published by the Colorado School of Mines *Magazine*. This statement may sound foolish, but it is true nevertheless. Here is the reason: No technical journal considers our magazine as a financial rival and therefore does not hesitate to reprint any original article of value we may publish, and give us credit. Practically every original article we have printed since the *Magazine* was started has been republished in from one to ten of the leading technical journals, depending on its originality and value. Send us that article first. The ultimate wider circulation will be of more value to you than the few dollars you may get for it elsewhere." [There is such a thing as killing the goose, however.—Editor.]

⁂

Learnin'

By Berton Braley

(*With apologies to Kipling*)

When I began as a mucker,
I was a husky young plug,
Always a takin' of chances
Down in the mine where I dug;
Miners said, "Kid, you be careful
Everywhere you may be at,"
But I laughed and got cute till I fell down a chute—
An' I learned about minin' from that.

After awhile I was drillin',
Runnin' a full-size machine,
Handlin' the fuses and powder,
Proudest young buck ever seen.
Shift Boss was Jimmy McLoughlin—
Great guy for safety was Jim;
And he licked me with skill when I tamped with a drill—
An' I learned about minin' from him.

Bobby McGuire was my partner—
Mighty wise buddy was Bob;
Taught me to set up my timbers,
Showed me the tricks of the job;
Used to say, " 'Nother shift comin',
Don't use up all of yer vim,
The boss has gone past, don't be workin' so fast"—
An' I learned about minin' from him.

There was one gang that I worked with,
Used to get tanked quite a bit,
Came to work bleary an' shaky,
Not very lively or fit;
Wouldn't test ground up above 'em—
Down came that shaky roof, flat!
With a crash an' a bang, it erased the whole gang—
An' I learned about minin' from that.

An' so I have learned as I labored
The ways an' the work of a mine,
How one way of doin' is crazy
An' others is sure to be fine;
An' the end of it's sittin' an' restin'
An' wishin' you'd saved up more pelf,
An' if you would know if my story is so—
Go learn about minin' yerself!

New Publications

Analyses of Coals Purchased by the Government During Years 1908-15. By George S. Pope. Pp. 118. Bull. 119, U. S. Bureau of Mines, Washington.

Quin's Metal Handbook and Statistics, 1917. Compiled by L. H. Quin. 6¼x4¼; pp. 211; 3s. 6d. The Metal Information Bureau, Ltd., London, England.

Abstracts of Current Decisions on Mines and Mining, to August, 1916. By J. W. Thompson. Pp. 72; Bull. 143, U. S. Bureau of Mines, Washington.

The Analysis of Copper and Its Ores and Alloys. By George L. Heath. 6 x 9; pp. 292; illus.; $3. McGraw-Hill Book Co., New York.

More extended review will be published later.

Report of the Secretary for Mines for the Year 1915; Including Reports of the Inspectors of Mines, Government Geologist, Mount Cameron Water-Race Board, Etc. Pp. 134. Tasmania Bureau of Mines, Hobart.

The "Mechanical World" Pocket Diary and Year Book for 1917. 4x6; pp. 453; illus.; 35c. by mail 40c. Emmott and Co., Ltd., Manchester. A Collection of Useful Engineering Notes, Rules, Tables and Data.

The Principles and Practice of Sampling Metallic Metallurgical Materials, with Special Reference to the Sampling of Copper Bullion. By Edward Keller. Pp. 102, illus. U. S. Bureau of Mines, Washington, D. C.

Weights and Measures; Report of Eleventh Annual Conference of Representatives from Various States held at the Bureau of Standards, May, 1916. 7x10; pp. 264; illus. U. S. Department of Commerce, Washington.

Practical Oil Geology. The Application of Geology to Oil Field Problems. By Dorsey Hager. Second edition, revised and enlarged. 5 x 7; pp. 187; illus.; flexible binding, $2. McGraw-Hill Book Co., New York, 1917.

Russian Mines; Covering Mining Concessions Worked by British Companies in Siberia. Compiled by A. N. Jackman. 5¼x8¼; pp. 50; paper; 1s. Financial Times, Ltd., London. With specially compiled map indicating position of various properties.

The Yukon Territory; Its History and Resources. 6½x10; pp. 233; illus.; paper. Mining Lands and Yukon Branch, Department of the Interior, Ottawa, Ont., 1916.

This book contains the most complete and authentic data of the Canadian Yukon yet published.

Refining and Utilization of Georgia Kaolins. By Ira E. Sproat. Pp. 59, illus. Bull. 128, U. S. Bureau of Mines, Washington.

Results of investigations to determine a method for economic separation of impurities from kaolin to make American deposits available for pottery manufacture.

Coal-Mine Fatalities in the United States, 1916. Compiled by Albert H. Fay. Pp. 42. U. S. Bureau of Mines, Washington.

Review containing details of causes of accidents and tables showing monthly records by states. A table of permissible explosives tested to Jan. 1, 1917, also is given.

Wilson's Mining Laws, United States. Arizona, California, Idaho, Colorado, Nevada, Oregon and Utah, Including Laws to Locate Oil Lands. Compiled by Calvert Wilson. 5½x8½; pp. 240; paper; $1. Baumgardt Publishing Co., Los Angeles, Calif.

Mineral Resources of Michigan, with Statistical Tables of Production and Value of Mineral Products for 1915 and Prior Years; with a Treatise on Limestone Resources, by R. A. Smith. Prepared under the direction of R. C. Allen. Pp. 402; illus. Michigan Geological and Biological Survey, Lansing.

Quarry Accidents in the United States During the Year 1915. Compiled by Albert H. Fay. Pp. 77. U. S. Bureau of Mines, Washington.

A classification of the different kinds of quarries is given, with monthly accident records and comparisons with metal- and coal-mining accidents, also the state laws in regard to the reporting of quarry accidents.

Accidents at Metallurgical Works in the United States During the Year 1915. Compiled by Albert H. Fay. Pp. 20. U. S. Bureau of Mines, Washington.

Data relative to cause, extent and locality of accidents in metallurgical plants. Statistical tables show accidents grouped according to character, state, type of work, etc.

American Exporter Export Trade Directory. Export Merchants, Manufacturers' Export Agents, Foreign Exchange Bankers, Foreign Freight Forwarders, Steamship Lines, Foreign Consuls, Etc., in Principal Ports of the United States. Compiled under the supervision of B. Olney Hough. Fifth Edition; pp. 536; $5. Johnston Export Publishing Co., New York.

Cobalt Alloys with Non-Corrosive Properties. By Herbert T. Kalmus and K. B. Blake. Pp. 37; illus. Canada Department of Mines, Ottawa.

Fourth annual report on investigations for the purpose of increasing the economic importance of cobalt. Gives details of tests of corrosiveness of iron-cobalt alloys—particularly roofing containing various percentages of cobalt.

Metal-Mine Accidents in the United States During the Year 1915. Compiled by Albert H. Fay. Pp. 114, illus. U. S. Bureau of Mines, Washington.

Accident statistics grouped according to types of mine, and mining methods employed. State laws for the reporting of metal-mining accidents in each state are given. Many interesting tables and diagrams show extent and character of accidents.

Blast-Furnace Construction in America. By J. E. Johnson, Jr. 6 x 9; pp. 415; illus.; $4. McGraw-Hill Book Co., New York, 1917.

Contents: Introduction; Handling the Raw Materials; Filling the Blast Furnace; The Boiler Plant; Blowing Apparatus; Hot-Blast Stoves; The Construction of the Blast-Furnace Stack; Cleaning and Washing the Gas; Handling the Iron and Cinder; Auxiliaries and General Arrangement of Plants; The Dry Blast; Index. More extended review will follow.

Selling Your Services. 5½x8; pp. 176; board covers; $1. The Sales Service Co., New York.

A short collection of brief pithy essays. Not a panacea for the man out of a job, but sound keen advice on points generally overlooked by the job hunter. The point of view is that selling a man's services requires the same approach and attack as selling commodities. The book has some type letters of application which are out of the ordinary and it is so interesting, so crisp and cheerful, that it should stimulate anybody to new lines of effort in job hunting.

Annuare pour l'An 1917, Public par le Bureau des Longitudes. 4x6; pp. 660; paper; 2 fr. Gauthier-Villars et Cie., Paris.

This book continues to appear, despite the war. In addition to the usual tables of celestial, physical and chemical constants, there are several interesting supplements. One of these deals at length with the daylight-saving problem, through setting the clock an hour ahead in summer. Another very interesting study, although not of so great everyday interest, is one bearing on the determination of the meter in terms of the wave length of light. As usual, this annual gives a great amount of information for the price.

Classified List of Searches Made in the Library. Compiled by the American Society of Civil Engineers. Pp. 22, 6x9. Reprinted from Transactions A. S. C. E., pp. 2086-2108.

This pamphlet contains a list of the searches made in the library of the American Society of Civil Engineers for the last 15 yr. In each case the cost of the search is given, and copies of them can be obtained by application to the librarian of the United Engineering Society with which library that of the A. S. C. E. is now consolidated. The footnote on each page states that the original cost is given, and that a discount of 50% is made to members of the society. This ruling has been changed, and copies of any of these searches may be obtained by anyone at the 50% discount.

Mechanical Engineers' Handbook. Lionel S. Marks, Editor-in-Chief. 4½ x 7; pp. 1836; illus.; flexible leather, $5. McGraw-Hill Book Co., New York, 1916.

Contents: Mathematical Tables and Weights and Measures; Mathematics; Mechanics of Solids and Liquids; Heat; Strength of Materials; Materials of Engineering; Machine Elements; Power Generation; Hoisting and Conveying; Transportation; Building Construction and Equipment; Machine-Shop Practice; Pumps and Compressors; Electrical Engineering; Engineering Measurements, Mechanical Refrigeration, Etc. This handbook is based on Hütte, arrangements having been made for use of such portions of the original handbook as are within the field of the mechanical engineer. Much of the book is new and has been prepared by a staff selected for their prominence in special lines.

Feldspar in Canada. By Hugh S. de Schmid. Pp. 125, illus. Canada Department of Mines, Ottawa.

The first part of this report comprises a review of the Canadian feldspar mining industry with detailed descriptions of the quarries and occurrences of feldspar in Canada. The second part treats of the mineralogical character of the feldspars, the occurrence of this mineral in other countries, and its uses and treatment. The feldspar resources of Canada are practically unlimited, pegmatite dikes being found over an immense area extending from Labrador through Quebec and Ontario and northward through northeast Manitoba into the Northwest territories. The future development of the feldspar-mining industry is dependent on the growth of domestic consumption. The present annual consumption of feldspar for all purposes in Canada is not more than 3000 tons, of which less than 400 tons appear on the returns as domestic mineral. By far the greater part of the spar quarried in Canada is consigned to American potters, who use it in their own works.

Hydro-Electric Power. By Lamar Lyndon. Vol. I, Hydraulic Development and Equipment. Vol. II, Electrical Equipment and Transmission. 6x9; pp. 499, and 360 respectively; illus.; $5 and $3 respectively. McGraw-Hill Book Co., New York, 1916.

These two volumes comprise practically all that is necessary for the mining engineer to know about hydro-electric development. For the engineer in a country where hydro-electric power development is possible, Volume I gives the methods and practice of preliminary investigation, and the design, construction methods and some typical costs of hydraulic transmission lines of different types. Volume II gives the design of hydro-electric power plants and the factors governing the choice of equipment. Finally, power-transmission lines are discussed and details of design and costs are given. The books throughout contain useful tables and photographs of installations. While written for hydraulic engineers, they are a most valuable asset to the mining engineer who has any hydro-electric problems to solve.

Principles of Oil and Gas Production. By Roswell H. Johnson and L. G. Huntley. 6x9; pp. 371; illus.; $3.75. John Wiley & Sons, Inc., New York, 1916.

Perhaps no two men are in a better position or better prepared to present the subject of oil and gas production in book form than are Messrs. Johnson and Huntley. This volume treats rather exhaustively the subjects of the origin and accumulation of oil and contains especially interesting chapters on the physical conditions in oil reservoirs, a subject which has received but scant attention in the past. The authors' views on oil accumulation are broad, and all possible factors are given due consideration and the subjects of extraction and production are well treated, and the book gives one a good insight into the many complex problems of these branches of the petroleum and natural-gas industry. Likewise there is much valuable and interesting information on oil land in general, leasing, reports, and valuations, and the last part of the book is devoted to brief descriptions of the oil fields of North America with lists of references to the literature in each case. On the whole the book is well presented and is a valuable contribution to the literature of the petroleum industry.

Engineering of Power Plants. By Robert H. Fernald and George A. Orrok. 6x9, pp. 586, illus.; $4. McGraw-Hill Book Co., New York.

This work is the collaboration of Professor Fernald of the University of Pennsylvania, and George A. Orrok, consulting engineer, formerly mechanical engineer with the New York Edison Co. This combination of the theoretical and the practical has resulted in a very good book with but little mathematics. The volume has 20 chapters on the following wide range of subjects: Sources of Energy; The Steam Engine; Electric Generators and Motors; Foundations; Condensers; The Steam Boiler; Chimneys and Mechanical Draft; Smoke and Smoke Prevention; Boiler Auxiliaries; Piping; Coal and Ash Handling; The Steam Power Plant; Variable Load Economy; Cost of Power; Hints on Steam Plant Operation; Power Transmission; District Heating; The Power Plant of the Tall Office Building; The Power Plant of the Steam Locomotive; Fuels; Internal Combustion Engines; Producer Gas and Gas Producers; Comparative Efficiencies and Operating Costs for Different Types of Installation; Compressed Air; Refrigerating Machinery and Hydraulic Power. Fifteen of these chapters have lists of problems to be solved by the reader. The book is copiously illustrated with charts, tables and cuts.

The American Petroleum Industry. By Raymond Foss Bacon and William Allen Hamor, with special chapters by F. G. Clapp, Roswell H. Johnson, J. P. Cappeau and L. G. Huntley. In two volumes; 6x9; pp. 446; illus.; $10. McGraw-Hill Book Co., New York.

This treatise fills a much-felt need and fills it well. It is in reality the first work of its kind published from the American viewpoint. It covers the petroleum industry from the point of well location and drilling up to the various refining processes. In the first volume are chapters on the composition, origin and accumulation of petroleum and a most interesting chapter on the history of the industry. The technology of petroleum production is well treated, though it is to be regretted that nothing appears in the text about oil storage or transportation. Likewise water and pressure problems in production have received but scant attention from the authors. These omissions, however, do not constitute a criticism, for the book is essentially devoted to oil refining, which subject is discussed exhaustively in the second volume. Throughout the two volumes there are ample illustrations, much valuable information in tabular form, and the references and footnotes are full and complete. This work represents great care and elaborate preparation on the part of its authors, and all those connected with the petroleum industry will doubtless find much use for it.

Personals

D. M. Liddell has returned from a professional visit to Florida.

R. St. John Dixon is with the Dome Mines Co., Ltd., South Porcupine, Ont.

C. O. Lindberg has changed his address in Los Angeles to 1216 Hollingsworth Bldg.

W. S. Pilling of Pilling & Crane, Philadelphia, has gone to California for a stay of several weeks.

Walter Douglas has been elected president of Phelps, Dodge & Co., succeeding Dr. James Douglas.

Angus McDonald, a pioneer of Manitoba mining, has enlisted in an artillery battery for service overseas.

Charles Mentzel has returned to New York from an eight months' trip in the interior of Colombia.

Rush T. Sill, of the firm of Sill & Sill, of Los Angeles, was in the Gold Reef district of California, on professional work.

Dr. James Douglas has resigned as president of Phelps, Dodge & Co., and has been appointed chairman of the Board of Directors.

Dr. Edward Keller, for many years connected with the Anaconda Copper Mining Co. as chemist and metallurgist, will sever his connection with that company on Apr. 1.

R. C. Coffey, formerly with the Schumacher Gold Mines, Ltd., of Porcupine, Ont., is now designing and building a 100-ton mill for the Lake Shore Mines, Ltd,. Kirkland Lake, Ont.

S. Ford Eaton, formerly of Vantrent, Calif., sailed from New York on the S.S. "Santa Marta" on Mar. 14 enroute to Magangué, Colombia, to become assistant manager of the Gumaco Mining Co.

L. P. Alford has resigned as editor of the "American Machinist" to establish himself in industrial engineering, and he has been succeeded by John H. Van Deventer, managing editor of the "American Machinist."

J. Leonard Replogle has been made president of the American Vanadium Co., Pittsburgh, succeeding James J. Flannery, who has become chairman of the board of directors. Mr. Replogle has been vice-president and general manager of sales.

Alva C. Dinkey, first vice-president Midvale Steel and Ordnance Co., has been appinted one of a committee of five by the Philadelphia Chamber of Commerce to coöperate with the quartermaster's department in the purchase of army supplies in case of war.

Fred W. Steinen, for many years connected with Corrigan, McKinney & Co., Cleveland, has resigned. He will devote his time to personal affairs and may engage in business in Cleveland. He has been succeeded by A. J. Sweeney, who has been his assistant.

W. R. Ingalls attended the recent meeting of the Canadian Mining Institute at Montreal. At the annual banquet, on the evening of Thursday, Mar. 8, he presented the medal of the Mining and Metallurgical Society of America to E. P. Mathewson, in recognition of his contributions to the advancement of metallurgy.

William B. Thompson, who resides on North Broadway, Yonkers, plans to organize a motor machine gun company of 150 men, to be independent of any other unit of the militia. It will be supplied with auto trucks for transportation of supplies and extra equipment and with a surgical staff and ambulance. The organization is to be supported by private subscription, but will be subject to either state or Federal call.

Herbert C. Hoover, head of the Belgian Relief Commission, sailed on Mar. 13 on a neutral ship for a Spanish port. He will go from Spain to Paris, and thence to London. After resuming direction there of the relief efforts, he hopes to cross the channel again and make his way into Belgium for a conference with the commission's agents, who have remained in that country notwithstanding the situation between the United States and Germany. Mr. Hoover, just before sailing, gave out the following statement: "We have 16 ships loaded with grain on the ocean now, and will start more. Ten millions of people are dependent for their very lives upon the arrival of these cargoes before mid-April. The commission has passed through a dozen crises before, but the faith that the cry of 10,000,000 helpless people cannot remain unheard, and the ability, courage, and resolution of my colleagues, has weathered every storm so far. We have lost 15 ships in the last two years out of 500 voyages. We have not thrown up our hands before on such incidents, nor will we do so now. At the worst this is in the nature of incidental misfortune, and it is unthinkable that most of our ships should not reach their destination. Every one of these ships that leaves a North Atlantic or Gulf port carries with her a safe conduct from the Swiss minister, acting upon authority from the German government, guaranteeing our flag, and their routes are accepted by the German government as safe from their attack."

Obituary

George Christian Hoffman, LL.D., formerly assistant director of the Canadian Geological Survey, died at Ottawa, Ont., on Mar. 6th in his 80th year after a short illness. He was born in London, England, and received his scientific education in Germany. He traveled extensively and held important positions in Africa and Australia, being for several years in charge of the Phytochemical Laboratory in Melbourne. In 1872 he came to Canada and joined the staff of the Geological Survey, serving for some time as assistant chemist and mineralogist and rising to the position of assistant director. He retired from active duties in 1907. Dr. Hoffman was a Fellow of the Institute of Chemistry of Great Britain, a member of the Pharmaceutical College of Quebec and of the Royal Society of Canada.

Societies

National Metal Trades Association will hold its next convention at the Hotel Astor, New York City, on Apr. 25 and 26. As usual, the meeting will be preceded by a session of the Administrative Council of the association on the day before the convention opens.

Committee on Engineering Coöperation. The report of the subcommittee, prepared after the meeting of Nov. 21, 1916, at Cleveland, Ohio, in accordance with the resolutions adopted at the second conference on engineering coöperation held in Chicago, Apr. 14, 1916, for presentation to the third annual conference, will be made at that meeting which will be held on Thursday, Mar. 29, 1917, at 1735 Monadnock Block, Chicago.

American Society for Testing Materials will hold its 20th annual meeting at Atlantic City, N. J., June 26-30, 1917. Headquarters will be at the Traymore Hotel. It is expected that special entertainment features will be provided for the meeting, concerning which more detailed announcements will follow. An entire afternoon will probably be devoted to a golf tournament and a putting contest for ladies, and an effort will be made to keep this afternoon free from all committee meetings and business interferences of any kind. In lieu of the usual smoker one entire evening, early in the meeting, will probably be reserved exclusively for the presidential address, followed by a reception open to members and ladies.

Institute of Metals will hold its annual general meeting in the rooms of the Chemical Society, Burlington House, Piccadilly, London, on Mar. 21 and 22, 1917. A special feature of the meeting will be a general discussion on metal melting, a subject which hitherto has received very little attention from the scientific societies. It has now assumed great national importance, since vast quantities of fuel—solid, liquid and gaseous—are used in metal melting, particularly for munitions making. Economies in the use of these fuels in the metal industries are generally realized to be possible, but the lack of comparative data has often hindered the adoption of the most efficient means of metal melting. The Institute of Metals is fortunate in having as its president Sir George Beilby, LL.D., F.R.S., the head of the new Government Board of Fuel Research. At the forthcoming meeting a series of six communications will be made bearing on all phases of the question of the melting of the nonferrous metals, whether by high-pressure or low-pressure gas, coke, oil fuel, or electricity. In addition to the metal-melting discussion, several important communications bearing on other phases of metallurgical work will be presented at the meeting.

American Chemical Society will hold its 54th general meeting at Kansas City, Mo., Apr. 10 to 14, 1917. Headquarters will be at the Hotel Muehlebach, registration office on the mezzanine floor, where banquet tickets will be available. The program will include a dinner on Apr. 10, tendered by the Kansas City section to the council, at the University Club, followed by the meeting of the council at the hotel. On Wednesday, Apr. 11, there will be the general meeting of the society in the Hotel Muehlebach, beginning at 10 a.m. Addresses of welcome by Hon. George H. Edwards, Mayor of Kansas City, and Dr. Frank Strong, chancellor of the University of Kansas. Then there will be the response by Julius Stieglitz, president American Chemical Society. General papers will include "The Economic Resources of the Kansas City Zone," by Arthur J. Boynton, at 2 p.m. public session, Hotel Muehlebach. Paper on "Petroleum and Natural Gas," by Dr. H. P. Cady, chairman, at 8 p.m., smoker, Hotel Muehlebach. All sessions and division meetings of the society will be held, as far as possible, in the Hotel Muehlebach, on the mezzanine floor. The remaining program includes on Tuesday night, Apr. 10, council dinner and meeting; Wednesday morning, Apr. 11, opening session; Wednesday afternoon, Apr. 11, public session, "Petroleum and Natural Gas"; Wednesday night, Apr. 11, smoker; Thursday morning, Apr. 12, division meetings; Thursday afternoon, Apr. 12, division meetings; Thursday night, Apr. 12, banquet; Friday morning, Apr. 13, division meetings; Friday afternoon, Apr. 13, excursions; Friday night, Apr. 13, open; Saturday morning, Apr. 14, excursions. Interesting excursions are being arranged covering trips to the following industries: Packing houses, flour mills and other food stuffs manufactories, zinc smelters, acids, cement, paper, soap, and structural steel factories, and serum laboratories, and probably also a petroleum refinery. A trip will also be made to Lawrence to visit the University of Kansas.

Industrial News

The Canadian Northern Railway Co. has organized a department of resources, and appointed Daniel F. Coyle, industrial commissioner with headquarters at Winnipeg.

Traylor Engineering and Manufacturing Co. has opened branch offices at Spokane, Wash., in charge of C. H. Abeling, and at El Paso, Tex., in charge of R. M. Peabody.

Homestead Valve Manufacturing Co., Homestead, Pa., announces the appointment of the following representatives to have exclusive representation of the Homestead quarter-turn cock and the Hovalco angle blowoff valve in their immediate vicinities: Queen City Supply Co., Cincinnati, Ohio, and Root, Neal & Co., Buffalo, N. Y.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Aerial Tramways—Grip for. Frederick C. Carstarphen, Trenton, N. J., assignor to the American Steel and Wire Co., Hoboken, N. J. (U. S. No. 1,218,372; Mar. 6, 1917.)

Aluminum Chloride—Art of Producing Aluminum Chloride. Maurice Barnett and Louis Burgess, New York, assignors to Alchlor Chemical Co. (U. S. No. 1,218,588; Mar. 6, 1917.)

Blasting—Electric Blasting Cap Protector. Ford Alexander, Taft, Calif. (U. S. No. 1,218,504; Mar. 6, 1917.)

Blasting—Miner's Blasting Box. Joseph S. Beeneck, Nanticoke, Penn. (U. S. No. 1,217,902; Mar. 6, 1917.)

Electric Induction Furnace. Parvin Wright, Vancouver, B. C. (U. S. No. 1,218,151; Mar. 6, 1917.)

Electric Furnace. Carl A. Pfanstiehl, Waukegan, Ill., assignor to Pfanstiehl Co., North Chicago, Ill. (U. S. No. 1,218,582; Mar. 6, 1917.)

Electric Furnace. Frank T. Cope, Alliance, Ohio, assignor to the Electric Furnace Co., Alliance, Ohio. (U. S. No. 1,218,058; Mar. 6, 1917.)

Electric Furnace Wall Construction. Ingenuin Hechenbleikner, Charlotte, N. C., assignor to Southern Electro-Chemical Co., New York. (U. S. No. 1,217,306; Feb. 27, 1917.)

Potash—Process of Producing a Soluble Potassium Compound. Harry P. Bassett, Catonsville, Md., assignor to the Spar Chemical Co., Baltimore, Md. (U. S. No. 1,217,388; Feb. 27, 1917.)

Potash—Process of Treating Potassium Containing Silicates and Phosphate Rock and the Product of Such Process. Harry P. Bassett, Catonsville, Md., assignor to the Spar Chemical Co., Baltimore, Md. (U. S. Nos. 1,217,389, 1,217,390; Feb. 27, 1917.)

Potash—Process for Extracting Potash and Alumina from Alunite. Paul J. Fox, Washington, D. C. (U. S. No. 1,217,432; Feb. 27, 1917.)

Pulley—Mine. James Boyd Anderson, Shickshinny, Penn., (U. S. No. 1,218,505; Mar. 6, 1917.)

Rock Drill. Roscoe E. Overman, Los Angeles, Calif. (U. S. No. 1,218,579; Mar. 6, 1917.)

Rock Drill. James C. Wright, Colorado Springs, Colo., assignor of one-half to T. L. Rippey, Dallas, Tex. (U. S. No. 1,218,149; Mar. 6, 1917.)

Rock Drill—Support. Daniel J. O'Rourke and Fred D. Holdsworth, Claremont, N. H., assignors, by mesne assignment, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,218,604; Mar. 6, 1917.)

Tungsten—Extraction of Tungsten from Tungsten Ores. John Cope Butterfield, Balham, London, England, assignor of one-half to Arthur Ashworth, Bury, England. (U. S. No. 1,217,914; Mar. 6, 1917.)

Tungsten—Production of Tungsten from Scheelite. John Cope Butterfield, Balham, London, England, assignor of one-half to Arthur Ashworth, Bury, England. (U. S. No. 1,217,913; Mar. 6, 1917.)

Uranium Steel—High Speed Steel. Joseph M. Flannery, Pittsburgh, Penn., assignor to Standard Chemical Co., Pittsburgh, Penn. (U. S. Nos. 1,210,625, 1,210,626, 1,210,627; Jan. 2, 1917.)

Editorial Correspondence

SAN FRANCISCO—Mar. 7

New Mining Corporations doubtless comprised a goodly proportion of the 1563 corporations applying for charters to the State Corporation Department in 1916. These 1563 corporations had capital stock aggregating $478,671,684. Of this number 1543 were permitted to issue 47,973,720 shares at an aggregate selling price of $159,405,141 and bonds of a face value of $34,808,636. The minimum selling price of the bonds authorized was $31,175,569—more than 95% of the par value. The maximum commissions allowed aggregated $2,836,515. The expense of operating the department for the first two years of its existence was $65,784.

Merit-Rating System of Insurance for California mines will be adopted by the insurance department of the Industrial Accident Commission, provided the scheme in preparation shall be approved by the state insurance commissioner. The subject of the application of merit rating to mine-safety work is discussed in "Bull. 4," by H. M. Wolfiin, chief inspector of mines. It is contended that the system will place mine-safety work on a basis of dollars and cents, rewarding the careful operator and penalizing the careless one, and be of advantage to every mine operator carrying insurance, immediately improving safety conditions so that the mines will be in condition for the necessary inspection to precede the application of the rating. The operator who neglects means of safety will not have the advantage of the same rate as the operator whose property is in the best of condition. Under the present system of writing insurance by the state the properly conducted mine is being taxed for the neglect practiced by the careless. It is generally recognized, however, by mine owners in California that no amount of safety work or inspection by the state or the government can accomplish the satisfactory results that follow the sustained effort of the operator and the coöperation of the employees in guarding against accidents. The responsibility laid upon the indifference and ignorance of men working underground is being more and more recognized by employees and decried by superintendents and foremen, as a result of the persistent work of the inspectors. The reduction in mine accidents has been gratifying not only to the Industrial Accident Commission but to the mine owners and employees. "Bull. 4" also discusses the need of preparation regarding mine fires and the use of rescue apparatus and attention is directed to the fact that many of the mines are abolishing candles and substituting acetylene lamps, not only reducing the hazard of mine fires but reducing the cost about 50% in the lighting of the mine.

BUTTE—Mar. 8

Mine Fires are again engaging the serious attention of the Anaconda Copper Mining Co. The fire that has been burning in the old Minnie Healy mine for the last 10 years, has broken through on the 1300-ft. level of the Leonard mine and the stopes of the Leonard, West Colusa and Tramway mines, where they come together, are burning between the 1300 and the 1600 level. Nearly 1000 men are laid off but it is expected that the St. Lawrence mine, which has been closed for several months, is now ready to resume and will be placed in operation during the coming week. Two powerful fans have been placed in the Mitchell air shaft of the Leonard and three large leads of hose turned on the fire. The fans drew the smoke and gases to the surface so that the fire fighters could battle with the fire in the stopes without much danger. A force began putting in bulkheads but before the fire could be headed off it had gone down to the 1600-ft. level. The fire spread to the old stopes of the West Colusa and Tramway mines which adjoin the Leonard. These three mines are among the largest producers of the Anaconda company, having a total daily output when in full operation of about 4000 tons. The fire has necessitated shutting off operations in a part of each of the three mines. It happened, however, that the Washoe and Great Falls smelteries are not able just now to handle the maximum output of the Butte mines and this curtailment will not affect the output of the smelteries. The present fire has served to show to what a high degree of efficiency the safety-first and first-aid work of the Anaconda company has been brought. A year ago last month the fire that broke out in the Pennsylvania mine cost the lives of 21 men. The fire which has just broken out in the Leonard is a far more extensive one than that which occurred in the Pennsylvania. Hundreds of men were in more or less danger but the first-aid teams with their helmets and apparatus were ready for the emergency. Many of the men employed in putting in the bulkheads and fighting the fire have been overcome by gases or smoke but the quick work of the well-disciplined first-aid teams has prevented any serious results with the exception of Foreman Lewin, who was killed before the conditions were understood. The fire has served to arouse a greater interest than ever before in the safety-first work of the company among the 16,000 miners employed in the mines of Butte.

DENVER—Mar. 7

Two Problems in Cripple Creek are (1) the northern extent of the crater and (2) the occurrence of silver ore occasionally found in these mines. The theory held by numerous mining men who have had opportunity to study the geology of the northern end of the district is that the crater extends much further to the north than has been supposed but that the breccia and tuff contents are covered by an enormous block of granite brought thither by a slide. It may be years before this is substantiated or disproved. The other problem relates to a recent find of rich silver ore in the Jerry Johnson mine at the presumed northern rim of the crater. Ore ranging from 50 to 83 oz. silver per ton has been found at a depth of 950 ft. As a rule, Cripple Creek ores carry little silver, the average ratio of gold to silver being, by weight, about 10 to 1. Occasionally there have been found pockets of tetrahedrite and galena that would contain considerable silver, one shipment, several years ago, from the Accident mine, running 2500 oz. silver and 25 oz. gold per ton.

Black Iron Group, recently purchased from the American Zinc Ore Separating Co., by the Empire Zinc Co., gives the latter control of practically all of Battle Mountain, near Redcliff, in Eagle County. This Black Iron group, which adjoins the Empire company's Iron Mask mine, derived its name from extensive replacement masses of manganese-iron ore. Mining was conducted here extensively in the 90's, the output being shipped to the steel works of the Colorado Fuel and Iron Co. at Pueblo. During the excavation of the manganese ore, masses of heavy material were encountered and avoided as both objectionable and worthless. Eventually the mine was worked out (?) and it remained closed so long that the workings caved. When the carbonates and silicates of zinc were identified at Leadville a decade ago, W. N. Buell, a miner who had worked in the Black Iron mine, recalled the character of the stuff purposely left in the mine, and secured a 10-yr. lease and bond from the Cheesman Estate of Denver. He convinced a Denver attorney, George C. Manley, that this old mine was still valuable and they formed a partnership. After they had done considerable development, they endeavored to interest capital but negative reports were rendered by various mining engineers. Finally W. G. Swart, then of the American Zinc Ore Separating Co., examined the mine and, upon a renewal of the bond and lease for 20 years, his company purchased a three-quarters interest from Buell and Manley. More development disclosed still further ore reserves. Last May the original lessees sold their remaining one-fourth interest to the American company for $80,000 and this company thereupon purchased the property outright from the Cheesman Estate. Already engineers are planning for increasing the power and milling facilities in the Iron Mask plant with the view of consolidating the dressing of the ores from both these great mines. Credit for recognition of the merits of the abandoned mine goes to Buell and it is satisfying to feel that he was able to obtain substantial remuneration for his sagacity and hard efforts.

SALT LAKE CITY—Mar. 9

Tintic Milling Co. at Silver City is installing a melting furnace to handle its precipitates at the plant. This will eliminate the high freight rates on the output, and cut down the cost of placing the bullion on the market. The mill is at present treating 150 tons per day by its chloridizing, roasting and leaching process. As soon as the changes and improvements now being made are completed, the capacity will be increased. Additional precipitation boxes and new tanks are being added.

Increased Wages at Park City were announced on Mar. 2. A notice was posted by the mining companies of an increase in wages of 25c. a day, taking effect Mar. 1. This increase is voluntary on the part of the mine operators, no increase having been asked, and is the result of high metal prices and the general prosperity of the camp. The principal active properties, the Silver King Coalition, Daly-Judge, Daly West, Ontario, Comstock-California, Naildriver, and New Quincy, are employing all told approximately 1000 men at present. Besides this numerous lessees are working. The wages before the increase were: $3.50 a day for muckers; for machine men, $4; for timbermen, $4.50; and $4.50 for engineers. Park City shipments for the week ended Mar. 2, were 1,892,310 lb., which is lower than usual. The railroad has been blocked several times on account of heavy snows.

Two Flotation Units at Ohio Copper Co.'s mill at Lark, Utah, are to be tried to determine the equipment best suited to the Ohio ore. The company is at present installing a 150-ton Janney unit and a standard M. S. unit of 500 to 600 tons daily capacity. These units should be in running order by the middle of April. As soon as it has been ascertained which of the two systems is better suited for the Ohio ores, it is the intention of the company to equip the mill fully with such system. The two units referred to are being installed in the slime plant, as at this point in the concentration of the ores there is the greatest loss. By this installation a large part of the loss in slime will be saved. R. W. Diamond, formerly connected with the research department of the Anaconda Copper Mining Co. has been placed in charge of flotation at Lark. The operations of the property suffered severely both during February and January, on account of the heavy snow and inability of the railroad to move the concentrates to the smeltery. Conditions at present are improved. There has been no change with respect to the transportation of the ore through the Mascottte tunnel to the mill, for which the company pays 15c. per ton; this situation is being studied for the purpose of ascertaining a fair charge for this service. Production for the months of January and February combined was approximately 1,000,000 lb. of copper. The mill at Lark is now treating about 2600 tons daily of 1% ore.

ELY, NEV.—Mar. 6

Tungsten Mines, Inc., is the new name of the Tungstonia Mining and Milling Co.'s operation in the Tungstonia district east of Ely. This is the most active property in the district and shipped over $60,000 worth of concentrates last year. The company is working a vein from 15 to 30 ft. wide under the management of A. R. Shepherd, who has no connection with the Salt Lake Tungstonia operations, as erroneously stated last week. The latter property is about 3 miles from the Tungstonia Mines, Inc.

GOODSPRINGS, NEV.—Mar. 8

Railroad to Goodsprings is considered probable. Camp was recently visited by San Pedro, Los Angeles & Salt Lake R.R. officials who are seriously contemplating the construction of a branch line from their main line at Jean to Goodsprings and thence to the western portion of the district which is now badly handicapped by lack of transportation.

In the Platinum-Copper Section of the district, there is considerabl activity in the vicinity of the Boss mine, where the following properties are undergoing active development: Oro Amigo, Platino, Azurite, Boss Extension and Scottish Chiefs. Several shipments of copper ore have been made from the Azurite, and platinum metals have been reported at the Oro Amigo, Platino and Scottish Chiefs, although no shipments have been made as yet. Other copper properties active in the district are the Copper Peak, Columbia, Copper Metals and New Dominion.

New 100-Ton Sampling Mill, built at Jean by Salt Lake capital and managed by J. B. Jenson, is now in operation handling custom ores from all parts of the district. Besides the larger producers, these mines are making regular shipments of lead and zinc ores: Green Monster, Sultan, Root Zinc Mining Co., Ingomar, Bill Nye and Bullion. Aërial tramways have recently been completed at the Ingomar and at the Bonanza property of the Root Zinc Mining Co. The Bullion has added another unit to its dry concentrating plant, and is making regular shipments of lead concentrates.

IRONTON, MINN.—Mar. 7

Labor Strike at Sultana Mine was called Mar. 1, by I. W. W. organizers. Approximately 80 men followed their leaders when the company refused their demand to go down and come up on company time. Last year, the I. W. W. strike on the Mesabi and Cuyuna ranges was directed mainly at the abolition of the contract system. The Sultana mine is one of the few mines on the Cuyuna range where the contract system is not used. Evidently the leaders called an ill-timed strike for within four days the strike was called off, without the company granting the demands.

DULUTH, MINN.—Mar. 9

State Investigation of Iron Industry has been recommended by the legislative committee of the real estate boards of St. Paul, Minneapolis and Duluth. The committee in its recommendation suggest that the legislature proceed at once, through a commission, to ascertain cost of mining and manufacturing of iron and steel products from ore mined in Minnesota. The object of this investigation is to encourage and develop the manufacture of iron and steel products within the state. To accomplish this, the committee recommends an increase in state charges on iron ore permanently removed from the state, proceeds to be used for creating other assessable property and to develop iron and steel manufacture in the state.

I. W. W. Agitators are at work in several places in the Lake Superior district and it is generally believed that an effort will be made to precipitate trouble about the time the shipping season opens. A general meeting has been called for Virginia, Minn., next week, when delegates will be in attendance from several of the ranges. An attempt was made to hold a meeting in Hurley, last Sunday afternoon, but the authorities took hold of the situation and prevented the gathering. However, a meeting took place later in the day in one of the other towns on the Gogebic range. Some effort has been made to gain members on the Marquette range and in the Iron River district on the Menominee range, but it is not known what sort of success they are having. It is feared that the agitators will endeavor to tie up the docks, realizing that they met with failure last summer when they started a strike on the Mesabi range. They discovered that the openpit mines could be kept running and that the stockpiles of the underground properties could be drawn upon. Some of the mining companies are preparing for trouble and are increasing their police forces. The Oliver Iron Mining Co. has put on additional men on all of the ranges where it has mines, and the others are doing likewise. One railroad company is already guarding its docks and bridges. It has been rumored repeatedly that agents of the German government are aiding the I. W. W. with money.

JOPLIN, MO.—Mar. 10

Increased Production Assured in the immediate future for this district. Last week, the local electric company finally completed repairs at its plant at Riverton, Kan., which will permit operation of electrically equipped mills for 20 hr. a day instead of 8 hr., which has been the limitation for several months. Within another fortnight the company expects to have other improvements completed that will permit operation of mills continuously throughout the 24 hr. In addition to this, the remarkable development of the Oklahoma field, in the Miami-Commerce-Picher camp, which really began only two years ago, is only now getting in full swing. Announcement of construction of at least a dozen new mills has been made since the first of the year, and mills begun last summer are just being completed and getting into the producing class, with the result that the average normal output of the camp now appears to have passed that of the sheet-ground district of Webb City-Carterville in Missouri, which has long held the lead in the district. The activity in the Oklahoma field is so great that miners are being drawn from the older camps, and there is a dearth of men, particularly shovelers, in Joplin and Webb City. If the price of ore remains near its present level for a few months, the indications are that the district output will be not far from 10,000 tons of blende per week.

WASHINGTON—Mar. 13

Ferro-metallurgy is of such importance that Van H. Manning, the director of the U. S. Bureau of Mines, concedes that one of the new mining-experiment stations should be placed in an iron-producing district. For this reason arrangements are being made on the practical certainty that one of the stations to be authorized in 1917 will be at Minneapolis, under a cooperative agreement with the University of Minnesota. The two other stations will not be located until Director Manning and some of his staff have made a personal investigation of the advantages offered by each place making application for a station. Strong bids for stations are being made by the petroleum and by the ceramic industries.

Government Mining Bureaus will not be hampered greatly by the failure of the Sundry Civil Bill at the last session of Congress as an early extra session is in sight. In the bill which passed the House and which was reported favorably by the appropriations committee of the Senate, the Geological Survey was allowed $1,550,520, and the Bureau of Mines $1,267,070. Important increases were allowed over the appropriations of the year previous. In order to map out their work intelligently these bureaus should have as much advance notice as possible as to the amount of money they will have at their disposal. This is particularly true in the mining bureaus because much of the expense is incurred in field work. Previously considerable losses have been occasioned from delays in enacting the Sundry Civil Bill. Consequently, it was feared that much inconvenience and loss would result when Congress adjourned Mar. 4 without passing this bill.

Mine-Rescue Work in metal mines is to receive additional attention from the U. S. Bureau of Mines and B. O. Pickard, of Phœnix, Ariz., has been appointed assistant mine-safety engineer to be in direct charge of this work. D. J. Parker, the mine-safety engineer of the Bureau, is a specialist in rescue and first-aid work in coal mines. He will continue to have general supervision over this branch of the Bureau's activities in both metal and coal mines. Mr. Pickard will take charge of his new work on Mar. 20, at a salary of $2520 per annum. The Raton mine-rescue car, which will be ready for service Apr. 1, will be in charge of C. A. Herbert, of Cameron, Mo., who has lately joined the Bureau.

JOHANNESBURG—Jan. 13

East Rand Proprietary Mines, once regarded as one of the best mining properties on the Rand, has fallen on evil times. Ever since the fiasco of five years ago, the stock has been steadily falling and although only about a third of the property has been exploited, the future of the property is impossible to foretell. At a vertical depth of 4000 ft., profitable ore disappeared, and although the western section of the property was expected to give good results, it proved too waterlogged and broken to be of value. A scheme has now been started to prove the reef at a vertical depth of 6000 ft. from the surface, not by continuing an incline shaft in the foot wall of the reef as is the custom on the Rand, but by driving two crosscuts from No. 27 level at a depth of 4000 ft. from the surface, and then sinking a 2000-ft. vertical shaft to the underlying reef. Apparently this scheme was hoped to avoid water troubles, but the crosscut has already tapped a heavy inflow of water, bringing the water to be pumped per day up to 4,000,000 gal. The cost of these crosscuts and sinking to the reef was estimated at £200,000. The proposal has met with some opposition among the directors of the company, and one of them has already resigned. General opinion seems to be that driving and sinking through so much dead ground was unnecessary, and that it would be much better despite water troubles, to continue the incline shafts in the foot wall of the reef, as already commenced at the Angelo Deep shafts. The dip ground of East Rand Proprietary is extensive, but it has never been proved by boreholes or otherwise.

The Mining News

ALASKA

KENNECOTT (Kennecott)—Company's Alaskan properties produced 7,090,000 lb. copper in February.

ALASKA MEXICAN (Treadwell)—Crushed in January 10,395 tons yielding $15,929 or $1.54 per ton; operating expenses, $14,182; operating profit, $1747; construction, $3236; loss, $1488; sundry income, $4441.

ALASKA TREADWELL (Treadwell)—In the 300-stamp mill, stamps in operation increased during January from 150 to 175, then to 225; tons crushed 29,554; yield $66,254 or $2.26 per ton; operating expense $35,974; operating profit $30,280; construction expense $11,273; sundry income $11,839; net profit $30,846.

ALASKA UNITED (Treadwell)—In January crushed 27,615 tons from Ready Bullion and 23,870 tons in 700-ft. Claim mill yielding respectively $53,817 and $44,019 or $1.97 and $1.86 per ton. Ready Bullion operating expenses were $43,339; operating profit, $10,478; construction expense, $681; net profit, $9796; sundry income, $2041. Operating expenses, 700-ft. Claim division, $70,136; operating loss $26,117; construction expense, $6730; sundry income, $2041. No. 5 diamond-drill hole on 2300 level showed 263 ft. $3.33; No. 4 hole 97 ft. $0.97.

ARIZONA

Cochise County

CALUMET & ARIZONA (Warren)—Company's mines produced in February 5,500,000 lb. of copper.

SHATTUCK-ARIZONA (Bisbee)—February output: Copper, 1,402,853 lb.; lead, 359,485 lb.; silver, 19,488 oz.; gold, 201.62 oz. Production about same in January.

Gila County

OLD DOMINION (Globe)—February copper production estimated at 2,600,000 lb., as compared with approximately 3,000,000 in January.

Pima County

SESAME COPPER CO. (Tucson)—New incorporation by County Auditor Charles M. Taylor, Gerald Jones, assistant United States attorney, S. A. Elrod et al.

Santa Cruz County

ROYAL BLUE MINING (Patagonia)—This company, operating the Wandering Jew and Royal Blue mines, will add to its concentrator this season.

Yavapai County

MONTE CRISTO (Constellation)—Reported that this rich silver mine, in drifting south on the 1000-ft. level, encountered copper-gold ore.

EAGLE (Constellation)—This copper-gold mine, near the Monte Cristo, has been taken over by Paul Development Co. of Douglas. Opened by tunnels.

CONSOLIDATED ARIZONA SMELTING (Humboldt)—The 1916 output of this smelting plant was: Copper, 11,989,139 lb.; 150,012 oz. silver; 5972 oz. gold. Company's own mines produced 5,829,500 lb. of the copper. About $360,000 was spent in plant improvements.

Yuma County

SOCORRO (Wenden)—This old gold-copper mine, now owned by George Ward, may be reopened by Los Angeles men.

BLACK REEF (Salome)—Equipment from the Palo Verde mine being installed and shaft mill deepened to 500 ft. A. W. Scott, manager.

CRITIC (Wenden)—At this old mine in Cunningham Pass district, a raise from the fourth to the third level encountered glance orebody carrying gold.

KING PLACER CONSOLIDATED (Quartzite)—Installing 2000-cu.yd. plant to treat the Plamosa gravels. Control also the Middle Camp group of 1600 acres and the King of 400 acres. F. W. Dunn, manager.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Upon completion of station at 3400 level drifting will begin north and south. About 100 men are employed.

NORTH STAR (Amador)—Shaft unwatered. Timbers, placed 26 years ago, still in good condition; no repairs necessary. The only caving during idleness of mine was in crosscuts. McIntyre and South Keystone claims will also be reopened; South Keystone Consolidated is developing.

CONSOLIDATED AMADOR (Sutter Creek)—Shaft clear of water to 1700 level; recent rains interfered with unwatering progress. Expect to reach 2200 level in about six weeks. Everything is ready for operation of new hoist, except motors, which have arrived at Martell station and will be hauled out as soon as road recently damaged by storms is repaired.

CENTRAL EUREKA (Sutter Creek)—James Kerfoot, engineer, who during the labor strike was driving an automobile that struck and fatally injured Obron Mijovich, will not be tried on a felony charge. Investigation by the district attorney showed that Mijovich sprang in front of the car in an endeavor to prevent Kerfoot from proceeding to the mine, and that he was accompanied by a number of strikers who were interfering with men who wished to work. Case was dismissed in magistrate's court.

Butte County

MORRIS RAVINE LEASING (Oroville)—Company reports rich gravel; some exceptionally coarse gold; old tunnel extended 580 ft.

Calaveras County

FOLTZ (West Point)—Mill installation complete, but operation retarded by recent storms. Work at other mines in district also interfered with by the exceptional winter.

QUARTZ GLENN (San Andreas)—Thieves recently robbed mill of three plates and cleaned off

amalgam from another. Mill idle, but was not carefully guarded because of its situation at the top of a hill impassable to teams and covered with heavy brush from mill to the river.

Mariposa County

MARY HARRISON (Bagby) — Reported that U. S. Smelting, Refining and Mining Co. is reopening this gold property.

Nevada County

EMPIRE (Grass Valley)—New residence of G. W. Starr, general manager, just completed and furnished ready for occupancy, was partially destroyed by fire Feb. 22. Cost, $20,000; loss, about $15,000, including specimens and curios, some of which were from South Africa.

San Bernardino County

GOLDEN WEST MINING CO. (Needles)—Permitted to issue 100,000 shares each to T. A. Dumont and H. C. Adams for 17 patented claims in Ibex mining district and to sell 50,000 shares at 50c. for purchase of machinery and development.

Shasta County

GARDELLA DREDGING CO. (Redding)—Two new dredges to be installed on Clear Creek, 4 miles south of Redding. Design contemplates reclaiming the land coincident with recovery of the gold. Expect to be ready to dig by Nov. 1. Lawrence Gardella, of Oroville, manager.

DONKEY COPPER (Ingot)—Development in progress by Mammoth Copper Mining Co. Electric-power line being installed, 1½ mi. long, to connect with Northern California Power Co. substation, for operation of hoist. Property near the Afterthought mine also under development by the Mammoth.

NOBLE ELECTRIC STEEL (Heroult)—Smeltery has produced since April, 1916, an average of 8 tons per day of ferro-manganese; closed temporarily Feb. 26 for relining furnace; expects to resume about middle of March. Employs 100 men at smeltery and 15 at mines nearby. W. W. Clark is superintendent of smeltery, and R. M. Finn of mines.

Sierra County

GREY EAGLE (Downieville)—Operations resumed; 20 men employed and 10 stamps dropping. S. C. Love in charge.

CROESUS (Alleghany)—Another bonanza strike made in west drift on 2200-ft. level. W. B. Pearson, superintendent.

BROWN BEAR (Goodyears Bar)—This gravel mine, bonded to J. G. Sartorius of San Francisco, Calif., and Phœnix, Ariz. Development to begin before May. 15.

ROCK CREEK (Downieville)—Shaft being sunk in tunnel, 1400 ft. from mouth, to tap gravel channel supposed to be feeder of famous Bald Mountain lead. Under bond to W. F. Copeland.

Siskiyou County

GRAY EAGLE (Happy Camp)—Boarding house to accommodate 100 men, an assay office and eight other surface buildings completed. One compressor is on the ground. Four miles of wagon road built from Indian Creek road up Luther Gulch and Thompson Creek to the main tunnel of the copper mine. Company is developing another property on Clear Creek and the Ely copper claim recently optioned. W. Koerner, manager.

BLUE LEDGE (Medford, Ore.)—First shipment of copper-gold ore via Medford to Tacoma smeltery showed total return from 34 tons of $3319; average per ton was 16% copper and $7.50 gold. Ore hauled by teams to Southern Pacific R.R. at $7.50 per ton, and in order to secure enough teams the rate has been raised to $10 per ton; teams can haul three tons and require three days. Manager Carnahan states that shipment can be increased if sufficient teams are secured. More than 500 claims have been staked in the district and prospects are good for much development. District is 14 mi. north of Happy Camp and is accessible to Klamath by an 8% trail which could be economically widened to accommodate teams and make the wagon haul shorter.

Tuolumne County

McCORMICK (Jacksonville)—The 20-ton Huntington mill running. New assay office under construction. Ten men are employed. Andrew McCormick, owner.

TUOLUMNE RIVER PLACER MINING CO. (Sonora)—Suit for damages amounting to $66,000 filed against Hetch Hetchy R.R. for dumping rock and refuse into the channel of river where mining company operates.

SCHMITZ (Chinese Camp)—Machinery from the Street mine at Tuttletown installed at this new property for development of chrome and magnesite. Shaft down 60 ft. and power drills will be installed. Eugene Schmitz and associates of San Francisco are developing.

COLORADO

Clear Creek County

TWO BROTHERS MINING AND LEASING CO. (Idaho Springs)—New incorporation formed by D. H. Elder, G. A. Duline, and W. C. K. Berlin. Head office in Denver. Will develop mining property in Clear Creek County.

GEM (Idaho Springs)—Mazda Leasing Co. developed payable ore in east heading on 1400-ft. level. Vein is 9 ft. wide in places. Raise is being driven on vein. Shipping about 50 tons per day, to Newton mill for treatment. A. C. Dart has lease on tunnel-level east heading and will extend it under the oreshoot opened by the Mazda company.

Custer County

SUNRISE (Westcliffe)—Development work on this Mt. Robinson property under way for some time. Results so encouraging that work on larger scale planned when weather will permit.

PASSIFLORA MINING AND MILLING (Westcliffe)—This company working old Herman group. Herman shaft reopened and sunk to 200-ft. level; levels driven and stoping under way. Shipping iron-silver ore. Equipped with steam hoist and compressor plant. Lease let on Passiflora claim; repairing shaft on parallel vein. Mill under consideration.

Ouray County

BENACK MINING CO. (Ouray)—New corporation to succeed partnership in operating Des Ouray group of about 50 acres, 7 miles southeast of Ouray. Development began with tunnel three years ago and to date 29 cars have been shipped to Salida smeltery averaging: Gold, 0.028 oz.; silver, 57.04 oz.; lead, 13.10%; copper, 2.14%; zinc, 5.23%. Average value realized per ton (zinc not included) was $42.11; average freight charges, $4.35, and average smelting charges, $5.59 per ton; if shipped under present prices, average value would have been $60.45 per ton. Orebody opened for 400 ft. with about 300 ft. of backs; shipping ore developed, 17,967 tons; besides the shipping ore, there is much ore of milling grade ranging from $10 to $25 per ton. M. M. Ferguson, 700 Fleming Bldg., Des Moines, Iowa, interested.

San Juan County

ALL O. K. (Silverton)—Small force engaged on development work. More extensive work planned for early spring.

MAYFLOWER (Silverton)—Recent development has opened considerable ore. Working force increased. J. H. Slattery and associates developing under lease. J. M. Sullivan is superintendent.

ASPEN (Silverton)—Being developed under lease by Johnson & Anderson. Ore containing gold, silver, lead and copper opened and is being shipped to Silver Lake custom mill.

GEORGIA

DU PONT POWDER (Rome)—Following the acquisition of the Harrison Bros. & Co. paint business, the company has taken over the operation of the bauxite mines of Harrison Bros. and R. S. Perry, near Six Mile station.

IDAHO

Shoshone County

KEYSTONE (Spokane, Wash.)—This copper-gold-silver property, near Blacktail landing on west shore of Lake Pend Oreille, sold to Armstead Mines Corporation, in which Henry H. Armstead of New York is interested. Opened to 900 ft. by No. 3 tunnel; No. 4 tunnel is in 1600 ft. and is to be continued 2200 ft. farther to cut vein at 1600-ft. depth. Mill contemplated. Daniel G. McLachlan, superintendent.

CONSOLIDATED INTERSTATE - CALLAHAN (Wallace)—Ore reserves reported a third larger than a year ago or about four years' supply at present rate of milling—14,000 tons per month, or 672,000 tons; on 100-ft. level below main tunnel—1600 ft. from surface—ore averaging about 8 ft. in width opened for 400 ft. At a point 350 ft. below main tunnel, Amazon tunnel provides outlet to Enaville side of hill; most of the mine waste now taken out through that opening. Plans for first unit of new Enaville mill sent to New York for approval; cost about $400,000. Old mill handling 450 to 500 tons daily; alterations proceeding; 400-ton flotation plant to be ready in May.

MICHIGAN

Copper

NEW BALTIC (Baltic)—Sump, 30 x 20 x 8 ft., finished and shaft sinking resumed.

SOUTH LAKE (Houghton)—Drifting on third level in west drift on Butler lode; in some places, lode has width of 60 ft.

MOHAWK (Mohawk)—Mechanical haulage being introduced at No. 6 shaft, compressed-air being the system of power used.

CALUMET & HECLA (Calumet)—Flotation experiments on fine sands reported to warrant commercial plant, which is to be built on shore of Torch Lake.

ISLE ROYALE (Houghton)—Hoisting resumed on Mar. 8 at No. 2 shaft, restoring production to former high level. Output curtailed about 20,000 tons by recent flooding.

LAKE MILLING; SMELTING AND REFINING CO. (Point Mills)—Company recently ordered 2000-kw. mixed-pressure turbine; which will utilize exhaust steam from the stamp heads of the mill.

CENTENIAL (Calumet)—Installing mechanical haulage on 37th level, operating same by compressed air, and making this level a main haulage level; chute cut from 33rd level.

HANCOCK (Hancock)—Winze, carried down on the incline of the formation from 44th to 49th level, has been cut through, and so has the winze from the 49th to the 53rd. They are divided into three compartments, a rock chute, a trackway for drills and timber, and a ladderway.

Iron

WAKEFIELD, (Wakefield)—Additional shovels purchased. Company will operate. Property to the west, which will be milled, now being opened.

HOLMES (Ishpeming)—First skip-load of ore brought to surface from new shaft and hoisting now going on regularly. Shaft sinking started in January, 1916. Only new mine opened in Ishpeming in a number of years.

MISSOURI

Joplin District

RIALTO (Baxter Springs, Kan.)—Building new 500-ton mill to cost $50,000.

YELLOWSTONE (Joplin)—In drilling campaign, seven holes showed two runs of ore—from 60 to 90 ft. and from 125 to 156 ft.

A. W. C. (Joplin)—Sinking new shaft at No. 5 mine, which will be connected with mill by incline tram, 400 ft. long.

N. ROSENBERG (Joplin) — With associates, has leased 1600 acres mining land near Mansfield, Mo. Will rebuild mill and encourage operation by sublessees. Mostly shallow mining.

LACLEDE (Commerce, Okla.)—Completed drilling holes on tract northeast of Commerce, on Tar Creek; practically all showed ore; shallowest 126 ft.; deepest 226 ft. Shaft under way.

VESUVIUS (Carthage)—One man killed and four injured when wind blew down bin containing considerable ore, Mar. 6. Twenty-six men in mine had to be taken out through nearby shaft, mill shaft being choked with débris.

SCHOOLHOUSE (Joplin)—This mine near Carterville leased to A. W. Canada, of Joplin, and associates, by Chapman-Hosley Co., which recently rebuilt mill and got mine in shape for operation.

BOSTON MEN purchased through August Mayerhoff, of Commerce, Okla., lease on Chubb land, 5 miles west of Baxter, for $35,000. Tract of 36 acres already drilled, but new owners will check drilling and later build mill.

M. K. & T. (Neosho, Mo.)—Under direction of Warren Heaton, will reopen Silver Plume mine, 6½ mi. northeast. Formerly good producer, but mill burned in 1909. Company to build modern 500-ton mill adjoining spur track of Missouri Pacific R.R.

WILLIAM FOSTER WHITE CO. (Picher, Okla.)—Building 500-ton mill west of Picher. Will use Dorr thickener, 40 ft. diameter, and a Dorr classifier will take place of the usual sand tanks—first time this plan has been tried in this field. F. L. L'Engle, Joplin, Mo., supt.

MONTANA

Beaverhead County

ARIZONA CONSOLIDATED (Armstead)—This London company is shipping ore.

BEAVERHEAD COPPER MINING (Armstead)—This company, financed by Pittsburgh, Penn. men, is steadily taking ore from 4- to 6-ft. vein, runing from 4 to 15% copper with some gold and silver.

Broadwater County

SCRATCH GRAVEL GOLD MINING (Helena)—At this property, about 2 miles northwest of city and adjoining the Franklin mine of the Cruse estate, a mill is being erected to treat the low-grade ores, varying from 1 to 4 ft. in thickness along the hanging wall. High-grade ore, averaging about 18 in., continues to be found along the foot wall. Charles E. Fryberger, who examined property, reported 49,711 tons of developed ore of gross value of $24.50 per ton, and probable ore was valued at $1,939,300.

Jefferson County

BALTIMORE (Boulder)—This mine in Boomerang Gulch reported to be shipping 10 carloads of rich copper ore weekly.

Silver Bow County

EAST BUTTE (Butte)—February copper output at company's Pittsmont smeltery amounted to 1,460,440 lb., as against 1,479,520 lb. in January. Silver output 40,900 oz. From some portions of mine, ore is running from 6 to 11% copper.

BUTTE & SUPERIOR (Butte)—Output for February amounted to 48,500 tons of ore from which 14,000 tons of concentrates were realized, containing 13,700,000 lb. of zinc and 285,000 oz. of silver. Minerals Separation case hearing postponed from Mar. 27 to Apr. 16. Modified process reported to be giving satisfactory results.

DAVIS-DALY COPPER (Butte)—Rushing work of opening its zinc veins to develop stoping ground for output of 500 tons a day; about 200 tons now being shipped to Ophir mill. The old Belmont crosscut is being put in shape and will be driven to the Emma vein, now being developed by the Anaconda company in the Emma mine. Mount Moriah and Silver King shafts in the zinc section are operated by leasers.

NEVADA

Clark County

ANCHOR (Goodsprings)—Operating 50-ton dry concentrator, and making shipments of lead concentrates and crude lead and zinc ore. Paying dividends monthly. Under management of R. W. Moore.

CHRISTMAS (Goodsprings)—First shipment of vanadium ore from the district made by this company during last month. Ore is descloizite (lead-zinc vanadate). Company also operates a 50-ton dry concentrator, completed in November, 1916, producing lead-silver concentrates shipped to Salt Lake smelters.

BOSS (Goodsprings)—First unit of leaching plant is completed, and will be tried out within a few days; utilizes special process evolved by General Manager O. J. Fisk and Metallurgist R. J. Goodwin for treating the complex copper-gold-platinum ores, using a chloridizing roast and sulphuric-acid leach. Shipments of high-grade crude ore being made at rate of about 300 tons per month, and company is now paying dividends quarterly. Shipments during 1916 included 410 oz. of platinum metals; will be greatly increased during current year.

YELLOW PINE (Goodsprings)—Producing approximately 1500 tons of zinc concentrate and 250 tons lead concentrate monthly. Large body of high-grade lead-zinc ore at north limit of workings, just below the 300-ft. level, has recently been blocked, and a 1000-ft. crosscut is being driven from the 700-ft. level to intersect this orebody. Crosscut now entering the ore zone and exposes ore of same grade as on 300-ft. level. Company has announced policy of paying dividends of 3c. per month throughout current year, a monthly disbursement of $30,000, "with such extra dividends as may be justified by the earnings." Fred A. Hale, Jr., general manager.

Elko County

STEWART MINING CO. (61 Broadway, New York)—This Idaho company will develop a group of Tuscarora gold mines; including the Nevada Queen, the Commonwealth, McCrystal, Extra, Sixteen to One and the Surprise Fraction claims. Former owners will erect 150-ton mill and if results are satisfactory, the Stewart will enlarge the mill and erect hydro-electric plant. Hiram C. Todd, of New York, president.

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Net realization in January was $19,506 from 26,500 tons; operating costs, $5.09; miscellaneous earnings, $0.18; net operating, $4.91 per ton. During month 1718 ft. of development was done at cost of $4.96 per ft.

Nye County

TONOPAH ORE PRODUCTION for week ended Mar. 3, was 9685 tons, valued at $174,330. Producers were: Tonopah Belmont, 2920 tons; Tonopah Mining, 2300; Tonopah Extension, 2380; Jim Butler, 750; West End 677; Rescue, 255; Halifax, 161; Montana, 80; Midway, 56; MacNamara, 53; and North Star, 53 tons.

MANHATTAN CONSOLIDATED MINES CO. (Manhattan)—This company, which closed its property in 1912, when at the 200-level refractory ore was encountered, is preparing to reopen the mine and sink shaft to 400-ft. level.

Storey County

ANDES (Virginia)—Extracted 19 cars of ore from 350 level.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Took out 138 cars of ore from surface tunnel.

MEXICAN (Virginia)—Installed electric hoist on 2500-2900 winze level, and reopened 2300 level workings. Mexican mill received 590 tons Union ore averaging $22.90 and having total gross value of over $13,000.

UNION CON. (Virginia)—High-grade ore taken from 2600 level, and four tons taken from Union-Sierra Nevada, the latter averaging $221.82. Exploration and development continued and ore extracted from 2400 and 2500 levels.

NEW MEXICO

Grant County

HANOVER-BESSEMER IRON AND COPPER (Fierro)—Fire destroyed on Mar. 6 new mill and power plant, under construction.

OREGON

Josephine County

GOLCONDA (Kerby)—Installing 30-ton concentrating mill at this chrome mine; marketed in 1916 about 3000 tons of 40% ore. Operating a series of lenses in a zone 300 ft. in width; high-grade lenses (38 to 45% ore) hauled to Kerby 25 mi.; low-grade ore (below 38% chromic oxide) will be milled to produce 55% concentrates. Lenses 15 to 60 ft. in width. Collard, Moore & Collard, owners.

SOUTH DAKOTA

Lawrence County

WASP NO. 2 (Deadwood)—Gold and tungsten both being produced: several shipments of tungsten concentrates made recently.

CUSTER PEAK (Roubaix)—Shaft repaired and sinking started; expect to sink to 500 ft. before lateral work is undertaken. Good copper showing was found at depth of 250 ft.

BISMARCK (Flatiron)—Will resume milling operations soon under management of F. C. Bowman.

NEW PURITAN (Deadwood)—Drifting at depth of 160 ft. to intersect high-grade vertical shoot is now in progress. Before starting milling, new electric hoist will be installed.

HOMESTAKE (Lead)—Several tungsten shipments made to eastern market during last few weeks; concentrator operating full capacity. Company will erect new $100,000 hospital.

ELK MOUNTAIN (Trojan)—Plant working nearly to full capacity of 100 tons daily; the lessees well satisfied with returns. Considerable body of ore opened and continued operations assured.

TENNESSEE

TENNESSEE COPPER (Copperhill)—January production of sulphuric acid 18,685 tons; copper, over one million pounds. Dispute with International Agricultural Corporation, over acid deliveries, settled out of court.

OCOEE COPPER CO. (Ducktown)—This company organized to develop 124 acres east of Ducktown Copper Sulphur and Iron Co.'s East Tennessee mine. Company reports that eight drill holes have indicated 361,000 tons of 3½% ore. J. I. Carter, of Chattanooga, president.

UTAH

Beaver County

COMMONWEALTH (Milford)—Crosscut from tunnel in direction of Moscow making about 5 ft. daily.

MONTREAL (Milford)—Report of operations for 1916, filed with state, shows: Gross income, $70,571; operating expense, $63,182; net proceeds, $7389. Operated under lease by Frank Mining Co.

Juab County

TINTIC SHIPMENTS for week ended Mar. 2, amounted to 171 cars by 15 shippers, as compared with 91 cars the week preceding. Increase due partly to better shipping conditions and to the fact that shortage of coal is being overcome. Considerable ore has accumulated, awaiting shipment.

CHIEF CONSOLIDATED (Eureka)—Ore running unusually high in silver has been opened beyond the large stope on the 1800 level; about 15 tons per day being mined. Work of enlarging main shaft is being done in four different places.

Piute County

DEER TRAIL (Marysvale)—This mine just south of Marysvale near mouth of Cottonwood Cañon again producing; shipping three or four cars of lead-silver-gold ore per week. Property was located in 1878 and shipped some high-grade galena ore by team to old Utah Southern R.R. in Juab County, but closed down soon after; worked off and on since. Ore occurs in a blanket or bedded vein on the contact of quartzite with overlying limestone. The ore at present is 12 ft. thick. A tunnel has been driven in the quartzite and several raises run to the ore. Galena occurs in lenses and bodies in ore of lower grade. Water piped from springs and small milling plant may be built. Controlled by the Salisbury brothers of Salt Lake.

Salt Lake County

OHIO COPPER (Lark)—Report of operations filed with state board of equalization shows: Gross income, $1,661,318; operating expense, $1,037,613; net proceeds, $623,704.

EMMA CONSOLIDATED (Alta)—Roads have been broken to property and a 35-ton shipment is being made. Galena ore is reported to have been opened in No. 2 raise.

CARDIFF (Salt Lake)—Net proceeds for 1916, reported to state board of equalization, were: $372,200; gross returns, $645,772. Expenses were: Transportation, $104,124; labor, $114,173; supplies, $44,295; improvements, $10,978.

SOUTH HECLA (Alta)—Report for 1916 shows 7962 tons of ore to have been produced on company account, having gross value of $166,915, and giving net stoping profit of $39,374. Lessees mined 1093 tons; gross value $21,989, from which company had net profit of $2847., giving total net stoping profit of $42,222. Development work during year amounted to 268 ft. of raising and 788 ft. of drifting and crosscutting. Total metal content of ore produced was: 301 oz. gold; 181,112 oz. silver; 1,454,372 lb. lead; 60,727 lb. copper; 896,327 lb. zinc; and 829,148 lb. iron.

Summit County

JUDGE MINING AND SMELTING (Park City)—New zinc plant has been limbered up and has produced spelter. Adjustments being made, and output will show a gradual increase.

CALIFORNIA-COMSTOCK (Park City)—Preparing for active development under new management. Peter Kaas, who has been leasing here, has three cars of ore on the market.

IOWA COPPER (Park City)—New machinery in place; mining will be resumed shortly. Communication at present by snowshoes only, heavy storms having put telephone line out of business.

THREE KINGS (Park City)—Winze from the bottom level—520 ft.—is down 180 ft. Some water has been encountered, and about an hour's pumping a day will be necessary. A streak running high in gold was cut recently 20 ft. above bottom of winze; will be further prospected by drifting.

SILVER KING CONSOLIDATED (Park City)—Operations suspended for a few days on account of coal shortage. Regular quarterly dividend of 10c. a share and an extra dividend of 5c. was declared Mar. 3, payable Mar. 31; will amount to $103,287, and bring total dividends to date to $1,212,705; last year, 45c. a share or $286,875 was paid. Several shipments of concentrates have been made from the new mill. New tunnel for the Thaynes Cañon section is in approximately 2000 ft.

CANADA

Ontario

DAVIDSON (Porcupine)—A 40-ton shipment, taken from three levels, is being prepared and test run will be made to determine grade and character of ore.

NATIONAL PORTLAND CEMENT CO. (Durham)—This plant producing about 2000 bbl. of cement daily from feldspar and limestone, has installed potash-recovery plant of 15 tons capacity under direction of Allan Granel.

PORT ARTHUR COPPER (1230 Traders Bank Bldg., Toronto)—Developing copper property at Mine Center, 180 mi. west of Port Arthur on Canadian Northern. Eleven cars, averaging 4%, shipped for testing and sampling purposes; ore contains gold and silver, also. Mill may be built. F. M. Connell, consulting engineer.

HOLLINGER CONSOLIDATED (Timmins)—At annual meeting, Managing Director Percy A. Robbins stated that he could safely add $1,000,000 to estimated value of ore reserves stated in annual report as $34,186,000 on Jan. 1, 1917. Mill additions to be completed in about six weeks; cost from $100,000 to $150,000 more than estimate of $750,000, owing to advance in machinery and supplies.

MEXICO

SANTA GERTRUDIS (Pachuca, Hidalgo)—Milled in January 12,676 tons; estimated profit, $11,880.

GREENE-CANANEA (Cananea, Son.)—February production: Copper, 5,100,000 lb.; silver, 144,610 oz.; gold, 815 oz. Copper output in January, 5,700,000 lb.

MEXICO MINES OF EL ORO (El Oro, Mex.)—In January, mill ran 19 days, crushing 7000 tons; total realizable value $194,000 or $27.71 per ton; operating expense $54,000; development $17,000; export tax, $19,000; total expense, $90,000 or $12.85 per ton; profit, $104,000.

HOWE SOUND CO. (734 Fifth Ave., New York)—This company's El Potosi and Chihuahua mines in the Santa Eulalia district are working; the former produces lead-silver ores, now shipped to El Paso instead of Chihuahua smeltery, as heretofore; the Chihuahua mine produces zinc ore, which is shipped to Colorado and Kansas smelteries. Mexican operations are under direction of W. J. Quigly, of El Paso, Texas.

CUBA

FRANCISCO MINING CO. (Los Acostas)—Has cut 30 ft. of ore on 100-ft. level about 75 ft. from shaft. Ore is of concentrating grade, principal mineral being cubanite. Drifting now in progress. W. E. Fenwick, superintendent.

COLOMBIA

NECHI MINES, LTD. (Zaragoza)—Returns from gold dredge for month ended Feb. 19 were $43,333 from 114,634 cu.yd., or about 26.5c. per cu.yd.

PATO MINES, LTD. (Zaragoza)—Rich yield from this dredge for 13 days ended Feb. 15; cleanup was $53,694 from 24,370 cu.yd. or over $2.20 per cu.yd. Damage to power dam by high water, late in 1916, not so serious as reported, only the top portion or addition having been carried away.

PERU

CERRO DE PASCO (Fundicion)—February copper output 5.352,000 lb., as compared with 6,172,000 lb. in January.

CHILE

CHILE EXPLORATION (Chuquicamata)—February copper production 6,056,000 lb.; in January 7.756.000 lb. Extension of capacity from 10.000 to 27,000 tons of ore daily again being considered and special meeting of Chile Copper Co. (holding company) is called for Apr. 16 to authorize issuance of $35,000,000 in new 6% convertible bonds, which have already been underwritten by Eugene Meyer, Jr., & Co., of 14 Wall St., New York; bonds convertible into stock at $35.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—January cleanup was $152,362 from various mills as follows: Tabowie, $34.808; Taracol, $32,607; Maibong, $26,318; Taracol cyanide plant, $54,517; Maibong tube-mill bullion, $4112; tonnage treated, 27.428; average recovery, $5.55 per ton; ore from Chintul and Tongkol mines proving of higher value than estimated; also No. 12 level stopes of Charabowie mine wider than expected. Final results for December from 27,123 tons $165,373; operating costs, $79,418; operating profit, $85,955; developments and improvements $5174; average yield, $6.10 per ton; average profit per ton, $2.98.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Mar.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
8	4.7500	75⅜	37⅛	12	4.7544	75	36⅞
9	4.7538	75⅜	37 5/16	13	4.7544	74⅛	36½
10	4.7544	75⅜	37⅛	14	4.7544	73⅛	36

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Mar.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	31⅛		9	9	10⅛
8	@32⅛	54	@9⅛	@9⅛	@10⅛
	31⅛		9	9	10⅛
9	@32⅛	53¾	@9⅛	@9⅛	@10⅛
	31⅛		9	9	10⅛
10	@32⅛	53½	@9⅛	@9⅛	@10⅛
	31⅛		9	9	10⅛
12	@32	53½	@9⅛	@9⅛	@10⅛
	31⅛		9	9	10
13	@32	53	@9⅛	@9⅛	@10⅛
	31⅛		9	9	9⅞
14	@32	53	@9⅛	@9⅛	@10⅛

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Mar.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
8	137⅛	136	151	201⅛	201	30⅛	47
9	136	135½	151	201½	201	30⅛	47
10	...	...	...	...	...	...	...
12	136	135½	151	200¾	199¾	30⅛	47
13	136	135⅝	151	200¾	200¼	30⅛	47
14	136	135⅝	151	202	201½	30⅛	47

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

NEW YORK—Mar. 14, 1917

All of the markets were dull during the last week. Lead showed distinct signs of becoming easier. Zinc, after a further showing of strength, also became easier.

Copper, Tin, Lead and Zinc

Copper—The business in copper was very small, much less than in the previous week. The market is extremely difficult to quote, and we generalize it as being unchanged during the early part of the week. In the latter part it became easier. Business for July delivery was done at 32¼c., for August, at 32c., for July-September, at 31½c., for July-October, at 31c., while a sale for July-December at 31c. was also reported. All of these prices were on regular terms. Some of the large producers held third-quarter delivery at 32c., but were undercut. A small volume of business for March and second-quarter delivery by a small producer which had reserved a portion of its output, was done at premium prices. However, at the close of the week premiums had contracted. There was some reselling and there was no demand worth mentioning for near-by copper, and no more talk of prices at 37c. and upward. April was offered at 35c., May at 34c., and June at 33c. Business for April-May delivery was reported done at 33c.

Domestic consumers were reluctant to contract for third-quarter delivery, which is the only market for which the producers can sell in quantity. There is uncertainty, which causes buyers to hesitate, with regard to several important conditions, especially what may be done by the American Government and what will be done by the allied governments. There is not much expectation, however, that the allied governments will enter the market in the near future.

The strike at the Nichols refinery continues unsettled. The men demand an increase of 5 to 9c. per hour, an 8-hour day and time-and-a-half for overtime.

Copper Sheets—There is no change in the situation as reported last week. We quote hot rolled, 42@44c. per lb.; cold-rolled 1c. per lb. higher. Wire remains at 37c. per lb., f.o.b. mill.

Tin—This market was very quiet.

Lead—Our forecast last week of relief in the tension proved to be correct, and during the last week supplies of lead came through much more freely. This was reflected in the market which gradually became easier. Lead for March delivery was still held at a premium and fancy prices continued to be realized, although not so easily as in the previous week. A noteworthy feature was the development of a considerable business for April and April-May delivery. While reports from several producers were more or less conflicting, as to volume of inquiries, it is certain that the tonnage of business booked was larger than in the previous week and we characterize the market as being broader and easier.

Zinc—In the early part of the week the market was stronger and sales were made as high as 10¾c., but that was above the average and reflected business done under especially favorable conditions. The demand was practically confined to March and April delivery. Producers were anxious to sell contracts for the entire third-quarter and were willing to accept for them fully half a cent below the price for March, but although they placed some business, they did not find buyers generally interested.

Zinc Sheets—Price of zinc sheets has not been changed. The market is active, quotation at $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The market continues quiet. Nominal prices range from 58@60c. per lb. for No. 1 ingots at New York.

Antimony—Market stronger, but very quiet. We quote 32c. February shipment from China quoted at 18½@19c., March, 15½@16c., and April at 15@16c., c.i.f., New York, duty unpaid.

Cerium-Iron Alloy—Price continues at $28 per lb. Safety-lamp alloy at $40.

Magnesium—Demand active. Prices range from $2.75 to $5 per lb. for 99.5%, according to quantity and condition.

Nickel—Price has advanced to 50@55c. per lb. electrolytic commands an additional 5c. per lb.

Quicksilver—Market quiet and slightly lower. We quote $105. San Francisco reports by telegraph $110, firm. Relatively lower price in New York accounted for by fact of recent arrivals, late on account of freight tie-ups, in excess of market requirements which had been supplied by express shipments.

Gold, Silver and Platinum

Gold—The Transvaal gold output for January, 1917, amounted to £3,324,418, as compared with £3,344,948 in January, 1916, and £3.289,705 in December, 1916. There has been withdrawn from the New York subtreasury $500,000 gold coin for shipment to Canada. The Bank of Cuba, New York City, also shipped $200,000 to Havana.

J. P. Morgan & Co. on Mar. 10 received $41,000,000 in gold from Canada for account of the British government. This is the largest consignment ever received in a single day. Receipts here of $8,500,000 more gold from Canada, with the arrival of $25,000,000 at Philadelphia, brings the total for this month to $62,500,000 and make for the year to date $213,500,000. Current heavy receipts are thought to be the forerunner of a new British loan here. The talked-of French loan for $100,000,000 will not be announced for the present.

Silver—The silver market has suffered a sharp decline the past week, London prices falling from 37 5/16 to 36 pence. Weaker exchange in China has led to some profit-taking sales. While the immediate tendency is weak, the general undertone is good, and large buying orders in London for coinage still continue.

Mexican dollars at New York, Mar. 8, 58¼@61¼c.; 9, 58⅛@61⅛; 10, 58½@61½c.; 12, 58¼@61¼c. 13, 58@61c.; 14, 57¼@60¼c.

Platinum—We quote $102½@105.

Palladium—We quote $85@90.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 10—Blende, basis 60% Zn, $90 for premium ore down to $85 for medium grade. Lead ore, basis 80% Pb. $113 per ton. Shipments for the week are 2931 tons of zinc ore, 109 tons of lead ore, and 407 tons of sulphur ore. For the year to date the figures are: 26,501 tons of zinc ore, 810 tons of lead ore, and 4261 tons of sulphur ore. Shipped during the week to separating plants, 4110 tons of zinc ore.

Joplin, Mo., Mar. 10—Blende per ton, high, $92.60; basis 60% Zn, premium ore, $90; medium to low, $90@80. Calamine, basis 40% Zn, $56@50. Average selling price, all grades of zinc, $86.42.

Lead, per ton, high, $125.25; base, 80% Pb. $123@120. Average selling price, all grades of lead, $119.13.

Shipments the week: Blende, 9888; calamine, 555; lead, 2384 tons. Value, all ores the week, $1,189,560.

Partial relief is gained with additional electric current and stronger gas pressure, enough that a shortage of labor is noticeable, which will become pronounced with the removal of the freight embargo.

Other Ores

Antimony Ore—Prices are a little easier, ranging from $2@2.25 per unit. The conditions of shipment from South America make business with that quarter almost impossible.

Chrome Ore—The 40% chrome ore remains at $1 per unit, but manifests an upward tendency.

Manganese Ore—Lump dioxide firm at 3¾c. per lb.

Molybdenum Ore—It is still difficult to make deliveries. Wulfenite has been sold at $2 per lb. of molybdenum content. Molybdenite if actually on the spot would probably bring the same price.

Strontium Ore—Prices essentially unchanged. 95% domestic offered at 2c., and 80% crude carbonate at 9c. per lb.

Tungsten Ore—We quote wolframite at $17 per unit.

Charles Hardy under date of Mar. 13 reports as follows: "Following the very active business of the previous week, the market continued very active. The foreign demand has been just as great as ever and our home buyers have come into the market not only for spot, but also for forward deliveries. Business has been done in South America at $16.50, f.o.b., Buenos Aires, and $16.65, f.o.b., Chilean port, for shipment to Europe. Here it has not been difficult to obtain $17 for high-class wolframite, and scheelite is quoted at 50c. above. During the past week a large order for ferrotungsten has been placed for home consumption, but Canada has also bought quite a considerable quantity. Also, the option has been exercised on the ore which is at the present time on the way to New York.

Other Minerals

(Quoted by Foote Mineral Co., Philadelphia, for car lots)

Barite—Commercial lump, $10 per ton net; bleached white, powdered, $25; off-color powdered, $14.

Fluorspar—Acid grade up to $38 per ton, metallurgical grade, $30. Ammonium and sodium flourides at 27c. and 13c. per lb. respectively.

Magnesite—All grades firm. Standard calcined, 3¼c. per lb.; domestic raw, 1¼c.; Greek raw, 2c. per lb.

Zirkite—Firm at 6c. per lb. for 77.5% ZrO_2; extra charges for milling to various degrees of fineness. The 95% silicate zircon, quoted at 6c. per lb.

Iron Trade Review

NEW YORK—Mar. 14

Times like these are without parallel in the iron and steel trade, says "Iron Age." Pig iron since January has been advancing in price by jumps and they have been frequently for two, three and four times the usual amounts. The advance in steel has been steady since the temporary halt in the middle of last year, but the biggest increments have been made in the last few weeks.

If export demand may be seized on as substantially the main reason besides Government's needs for the later price increases, it is not yet certain that foreign buying will be checked. Large offerings in some forms of finished steel have been made at the new prices. Domestic purchasing meanwhile has not by comparison been of a large order, with some seasonal exceptions, but the advances have now had the effect of driving in many consumers for mill protection at prices below the new levels.

Thus far it is not clear that the pressure on the producers will be relieved. Certain it is that operating and sales departments are résisting vigorously a condition in which their hands are tied by commitments many months in the future.

The volume of forward buying in pig iron is particularly significant, in view of the prices involved.

PITTSBURGH—Mar. 13

Last Thursday the Carnegie Steel Co. announced the following advances: Steel bars, $7 a ton to 3.35c.; shapes, $7 to 3.60c.; plates, $15 to 4.50c., these advances at once becoming general. They followed advances the preceding Monday of $4 a ton on wire products and welded tubular goods generally. Sheets have since advanced $5 a ton. The advances are by a wide margin the greatest that have ever occurred within a similar time in the history of the steel industry. The mills are sold up solidly, with occasional exceptions, into the new year, and Government orders just placed or about to be placed will throw deliveries to ordinary domestic consumers still later than was expected. Whatever deliveries the Government needs are to be given, and prices charged are made satisfactory, with no reference to regular open market prices.

The Steel Corporation's increase of 102,643 tons in unfilled obligations during February, when the steel market appeared to be quiet, indicates that a great deal of routine contracting was put through, covering regular customers for the late deliveries of the year, while some Government tonnage was probably included.

Since the first of the year fully 1000 locomotives have been ordered, apart from export business, or nearly one-third as many as in the past two years, while domestic freight car orders total about 20,000 cars, or about one-fourteenth as many as in the two years. Demand for locomotives continues despite the high prices.

Traffic conditions have improved slightly. Production is increased a trifle and most of the mills have made a beginning at shipping the steel accumulated in the past few months.

Pig Iron—Basic iron, unchanged at $30, valley, since the beginning of December, has started to move, sales of about 40,000 tons having been made in the past few days at $31 to $33, and $32 is now clearly the minimum. Considerable demand has come from points outside the usual tributary territory. Bessemer iron is stronger, with recent sales at $36, valley, for late delivery, and $37 readily obtained for prompt. Foundry is unchanged at $35@36 for second half and $36@38 for prompt. All prices quoted are f.o.b. valley furnaces, prices delivered Pittsburgh being 95c. higher.

Steel—The market is very strong for early deliveries, at not under $65 for billets or sheet bars, but consumers show no interest in forward deliveries. The termination of present shell contracts Mar. 31 will release considerable steel, while steel-making capacity will increase, through new construction, much more than steel finishing capacity.

Ferroalloys

Ferromanganese—Quotations for domestic remain at $300 for prompt, $275 for third-quarter and $250 for fourth-quarter, delivered, but there is not much buying. Most of the English producers have withdrawn $185, seaboard.

Ferromolybdenum—Firm at last-quoted price of $4 per lb.

Coke

Connellsville—The spot market has softened further, with better car supplies, spot furnace being $9.50@10 and spot foundry $11@12. Contract is quotable nominally at $7@8.50 for furnace and $7.50@8.50 for foundry.

STOCK QUOTATIONS

N. Y. EXCH.†	Mar. 13
Alaska Gold M.	7⅛
Alaska Juneau	7⅛
Am. Sm. & Ref., com.	104⅛
Am. Sm. & Ref., pf.	111⅛
Am. Sm. Sec., pf. A	101⅛
Am. Sm. Sec., pf. B	96⅛
Am. Zinc	37
Am. Zinc, pf.	68
Anaconda	83⅜
Batopilas Min.	1⅛
Bethlehem Steel	140
Bethlehem Steel, pf.	118
Butte & Superior	47
Cerro de Pasco	38⅛
Chile Cop.	25⅛
Chino	58⅛
Colo. Fuel & Iron	47
Crucible Steel	65⅞
Dome Mines	19
Federal M. & S.	13⅛
Federal M. & S., pf.	42⅛
Great Nor., ore ctf.	34
Greene Cananea	44
Homestake	128½
Inspiration Con.	59⅛
International Nickel	41⅛
Kennecott	45⅛
Lackawanna Steel	84⅛
Miami Copper	41
Nat'l Lead, com.	56
National Lead, pf.	110
Nev. Consol.	24⅛
Ontario Min.	5⅛
Quicksilver	2
Quicksilver, pf.	2⅛
Ray Con.	28⅛
Republic I. & S., com.	79⅛
Republic I. & S. pf.	102⅛
Sloss-Sheffield	64⅛
Tennessee C. & C.	15⅞
U. S. Steel, com.	110⅛
U. S. Steel, pf.	118
Utah Copper	111⅛
Va. Iron C. & C.	59

N. Y. CURB†	Mar. 13
Buffalo Mines	1.15
Butte & N. Y.	2⅛
Butte C. & Z.	10⅛
Caledonia	.65
Calumet & Jerome	1 1/16
Can. Cop. Corpn.	1 1/16
Carlisle	6⅛
Con. Ariz. Sm.	2 1/16
Con. Coppermines	3⅛
Con. Nev.-Utah	⅛
First Nat. Cop.	3
Goldfield Con.	.58
Goldfield Merger	.07
Granite	.25
Greenmonster	2
Hecla Min.	8
Howe Sound	6⅞
Jerome Verde	2
Joplin Ore & Spel.	‡ .30
Kerr Lake	4⅛
Magma	48⅛
Majestic	⅛
McKinley-Dar-Sa.	.50
Mother Lode	.40
N. Y. & Honduras	15
Nipissing Mines	8
Ohio Cop.	1⅛
Ray Hercules	4⅛
Rochester Mines	.56
St. Joseph Lead	‡19
Seneca	13
Standard S. L.	.75
Stewart	1/16
Success	.50
Tonopah	6
Tonopah Ex.	3⅛
Tribullion	.50
Troy Arizona	.59
United Verde Ext.	38⅛
United Zinc	5⅛
White Knob, pf.	17⅛
White Oaks	2
Yukon Gold	2

SAN FRAN.*	Mar. 12
Alta	.03
Andes	.17
Best & Belcher	.05
Bullion	.02
Caledonia	.16
Challenge Con.	.05
Confidence	.08
Con. Virginia	.09
Gould & Curry	.02
Hale & Norcross	.06
Jacket-Cr. Pt.	.04
Mexican	.06
Occidental	.65
Ophir	.02
Overman	.03
Savage	.05
Seg. Belcher	.02
Sierra Nevada	.05
Union Con.	.40
Utah Con.	.01
Belmont	4.40
Jim Butler	.73
MacNamara	.08
Midway	.16
Mont.-Tonopah	.22
North Star	.16
Rescue Eula	.27
West End Con.	‡ .70
Atlanta	.13
Booth	.10
Comb. Frac.	.05
D'field B.B.	‡ .02
D'field Daisy	.03
Florence	.19
Jumbo Extension	.29
Kewanas	.19
Round Mountain	.44
Silver Pick	.11
Argo	.05
Ariz. Central	.10
Big Jim	1.28½
Lazy Boy	.06
Nellie	.18
Tom Reed	2.06½
United Eastern	4.50
United Western	.02

BOSTON EXCH.*	Mar. 13
Adventure	3⅛
Ahmeek	102
Algomah	.95
Allouez	68⅛
Ariz. Com., ctfs.	13⅛
Bonanza	.30
Butte-Ballaklava	1⅛
Calumet & Ariz.	82
Calumet & Hecla	550
Centennial	21
Copper Range	63⅛
Daly West	2⅛
Davis-Daly	6
East Butte	14⅛
Franklin	8
Granby	85
Hancock	17
Hedley	16
Helvetia	45
Indiana	3⅛
Island Cr'k, com.	63
Isle Royale	33
Keweenaw	3⅛
Lake	13⅛
La Salle	4
Mason Valley	6⅛
Mass	13⅛
Mayflower	2⅛
Michigan	3⅛
Mohawk	85⅛
New Arcadian	4⅛
New Idria	15
North Butte	23
North Lake	1⅛
Ojibway	2
Old Colony	2⅛
Old Dominion	66
Osceola	93⅛
Quincy	88
St. Mary's M. L.	85
Santa Fe	1⅛
Shannon	9
Shattuck-Ariz.	28
So. Lake	4
So. Utah	.25
Superior	14
Superior & Bost.	5⅛
Tamarack	58
Trinity	4⅛
Tuolumne	1⅛
U. S. Smelting	62⅛
U. S. Smelt'g, pf.	50⅛
Utah Apex	2⅛
Utah Con.	18⅛
Utah Metal	6
Victoria	5
Winona	4⅛
Wolverine	45
Wyandot	1⅛

BOSTON CURB*	Mar. 13
Alaska Mines Corp.	1⅛
Bingham Mines	10⅛
Boston Ely	.35
Boston & Mont.	.64
Butte & Lon'n Dev.	.22
Calaveras	4
Calumet-Corbin	.02½
Chief Con.	2⅛
Cortez	.20
Crown Reserve	.35
Crystal Cop.	.88
Eagle & Blue Bell	2⅛
Houghton Copper	1⅛
Intermountain	1⅛
Iron Cap Cop., pf.	16
Mexican Metals	.19
Mines of America	1⅛
Mojave Tungsten	.50
Nat. Zinc & Lead	.52
Nevada-Douglas	2⅛
New Baltic	2
New Cornelia	17⅛
Oneco	.60
Pacific Mines	.35
Rex Cons.	.38

SALT LAKE*	Mar. 13
Big Four	.72
Black Jack	.04½
Cardiff	4.00
Colorado Mining	.16
Crown Point	.04
Daly-Judge	8.60
Emma Cop.	1.31½
Empire Copper	1.50
Gold Chain	.14
Grand Central	.52
Iron Blossom	1.27½
Lower Mammoth	.03
May Day	.10
Moscow	.12
Prince Con.	1.30
Seven Troughs	‡ .03½
Silver-King Coal'n.	3.15
Silver King Con.	4.25
Sioux Con.	.15
So. Hecla	1.30
Uncle Sam	.04
Wilbert	.12
Yankee	11⅛

TORONTO*	Mar. 13
Bailey	.05
Beaver Con.	.43
Chambers Ferland	.11
Coniagas	4.20
La Rose	.50
Peterson Lake	.12
Right of Way	.04
T. & Hudson Bay	55.00
Temiskaming	.53
Wettlaufer-Lor.	.07
Dome Exten.	.26
Dome Lake	.21
Foley O'Brien	.60
Hollinger	5.15
Jupiter	.28
McIntyre	1.82
Newray	1.12½
Porcu. Crown	.66
Schumacher	.60
Vipond	.43
West Dome	.27

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Mar. 13
Cresson Con.	6.00
Doctor Jack Pot	.07½
Elkton Con.	.10
El Paso	.40
Findlay	‡ .04
Gold Sovereign	.04½
Golden Cycle	2.44
Granite	.50
Isabella	.19½
Mary McKinney	.20
Portland	1.77
Vindicator	.80

LONDON	Feb. 24
Alaska Mexican	£0 12s 6d
Alaska Tre'dwell	2 10 0
Burma Corp.	3 18 9
Cam & Motor	0 9 9
Camp Bird	0 5 6
El Oro	0 7 6
Esperanza	0 8 0
Mexico Mines	4 0 0
Nechi, pfd.	0 2 6
Oroville	0 15 3
Santa Gertrudis	0 9 0
Tomboy	1 0 0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935		23.708	27.597	
April	50.250	64.415		23.709	30.662	
May	49.915	74.269		23.570	35.477	
June	49.034	65.024		23.267	31.060	
July	47.519	62.940		22.597	30.000	
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310		107.714		136.000	
April	27.895		124.319		137.389	
May	28.625		135.457		152.522	
June	26.601		112.432		137.455	
July	23.865		95.119		125.500	
Aug.	26.120		110.283		126.304	
Sept.	26.855		113.905		134.071	
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	85.813
February	42.717	51.420	181.107	98.974
March	50.741		193.609	
March	51.230		199.736	
May	49.125		196.511	
June	42.231		179.466	
July	38.510		168.357	
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	70.500
February	6.240	8.636	6.164	8.595	31.988	30.500
March	7.136		7.375		34.446	
April	7.630		7.655		34.368	
May	7.462		7.332		32.967	
June	6.936		6.749		31.011	
July	6.352		6.185		28.137	
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846		16.676		95.048	
April	16.695		16.525		99.056	
May	14.276		14.106		94.217	
June	11.752		11.582		68.591	
July	8.925		8.755		50.750	
Aug.	8.730		8.560		51.587	
Sept.	8.990		8.820		52.095	
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ¦ Not reported.

Pig Iron, Phila.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81		19.20		19.45	
April	21.65		18.95		19.45	
May	21.78		19.11		19.58	
June	21.95		18.95		19.34	
July	21.95		18.95		19.20	
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.